FLIGHT
and
AIRCRAFT ENGINEER

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The Outlook

Another Mystery

ONCE again we have to mourn the loss of lives in an air accident; once again the aircraft involved is an Avro Tudor belonging to British South American Airways Corporation; and once again the machine has disappeared without trace.

The very deepest sympathy must be felt by all, not only for the victims in this latest mishap, and their relatives, but for A. V. Roe and the Corporation. Both do appear to have had more than their fair share of bad luck, and the mystery which surrounds the disappearance makes well nigh impossible the formulation of any opinion as to plausible causes.

Bermuda is the common denominator in the two cases, of vanishing aircraft, but there the similarity ends, and no conclusion can be drawn from the fact. In the case of the *Star Tiger*, the machine was on its way to Bermuda, was flying at night, and possibly at fairly low height. The *Star Ariel* had but recently left Bermuda, was flying at a considerable height and, it seems, in good weather.

The only thing that appears certain in this puzzling disappearance is that whatever catastrophe overtook the aircraft, it must have been of a nature so sudden that there was no chance for the radio operator to send out any signal.

Several possibilities exist, none of which can be held to amount to probabilities. It is conceivable, but unlikely, that an airscrew burst and in so doing damaged the front part of the fuselage in such a way that the pilot's controls became inoperative and the machine went into a violent spin which prevented the radio operator from working his equipment, even if it were in working order.

Sabotage *could* be the cause, but again it is not a very likely explanation. Or again, although the weather is reported to have been generally fine, one can visualize the possibility that the pilot flew into the top of cumulo-nimbus, in which disturbances are known to be sometimes so severe that they would break up any aircraft. It is unlikely that an experienced pilot would do this deliberately.

Finally, it appears just possible that the aircraft may have flown into an area of clear-air gusts of a violent nature, such as those for the exploration of which the B.E.A. Gust Research Unit at Cranfield was formed. Of the unlikely possibilities which we have outlined, this is, perhaps the least unlikely.

Putting It Across

HAS refuelling in flight a future, or has it not? That is a question to which it is high time an answer was given. Sir Alan Cobham has struggled for years, not only to develop a system but to convince people of its technical practicability and economic usefulness. It would be hard to say which task has been the more difficult.

Sir Alan's chief engineer, Mr. Latimer-Needham, read a paper on January 13th before the annual meeting of the American Society of Automotive Engineers, in which he stated the case very thoroughly. It is to be hoped that he found his audience sympathetic, for the Americans have by themselves, and in conjunction with Sir Alan, done quite a lot of experimentation with refuelling in flight, and recently gave a demonstration by flying a large bomber farther and with a greater bomb load than ever before.

In the summary of Mr. Latimer-Needham's paper which we publish this week, there was not the space to deal with all the details, but sufficient has been included to enable readers to form a fairly clear idea of what is involved.

That refuelling in flight is feasible from the technical and operational points of view was indicated by the tests made some time ago by B.S.A.A. and B.O.A.C.

The results are still being analysed, and no official decision has been made as to the adoption of the system.

The cost of refuelling in the air is not easy to assess, but as Mr. Latimer-Needham pointed out, so many incidental savings attend its use that they may well offset the cost. The lecturer estimated that the actual transfer of fuel, assuming two per day, should cost in the neighbourhood of £250. Greater traffic density and frequencies would reduce the figure. One refuelling per day, using two tankers (one as a standby), would increase the cost to £400 or £450. So cost reduction is largely dependent upon many airlines using the system.

On the technical side he did not specify the highest aircraft speeds at which fuel can be transferred. He did, however, mention the use of pumps instead of relying on gravity for the transfer. That would appear to indicate the possibility of line-astern flying, in which the air drag on the hose would, presumably, be nothing like as great as it is with the large bight of hose used at present.

Morale in the R.A.F.

CONCERN for the well-being of the R.A.F. is voiced on every side, and participants in the House of Commons Debate last week touched upon some of the graver aspects of a serious situation. Headlines were made by the Air Minister's admission that morale in the Service is "not entirely satisfactory," though discerning observers have been only too aware of this since the start of the general post-war decline.

Not unnaturally, the shooting-down of R.A.F. aircraft near the Palestine-Egypt battle area was instanced as an example of the kind of thing which, in the words of W/C. Millington, causes "considerable lowering of morale, not only of airmen but of their next-of-kin, who see their husbands sticking their necks out in what the next-of-kin consider to be unnecessary directions."

Disastrous as this incident was, however, it did not, in our view, warrant the assertion that if there was any lowering of morale, this was due to the political usage of the R.A.F.

The reasons underlying such indiscipline and discontent as may exist are as complex as the structure of the Service itself. They must be discovered and dealt with in the same resolute, systematic manner in which technical and operational problems are solved. That the dark and dangerous corner marked "manpower" will be negotiated in time may be assumed. But already "equipment" is beginning to appear as the next danger spot that will need attention.

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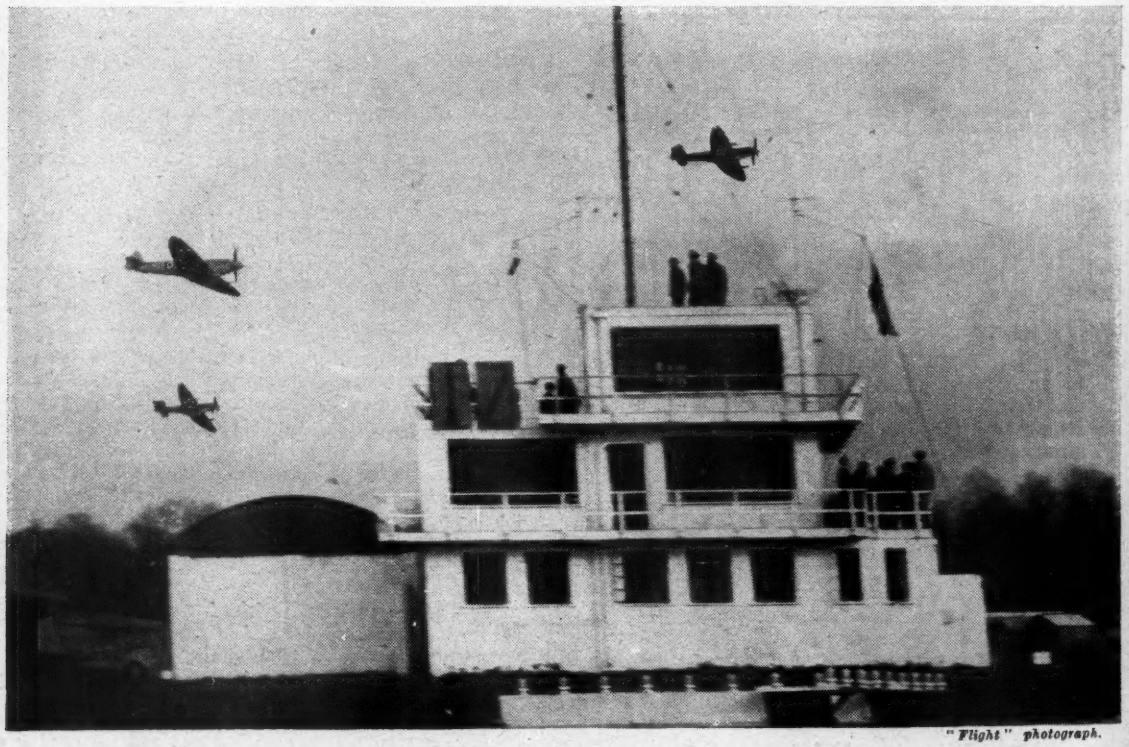
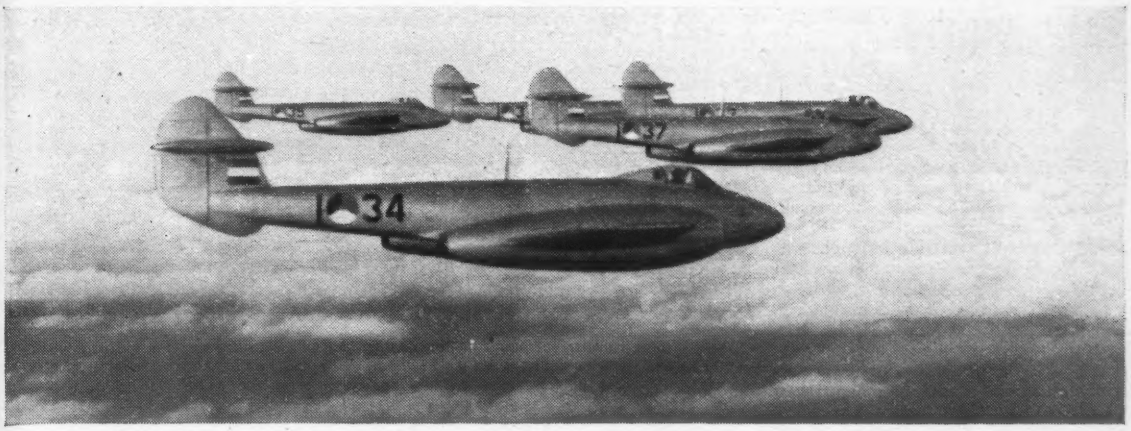


"Flight" photograph.

SUNDAY STRIKE: Seafires of three Royal Naval Volunteer Reserve (Air) Squadrons—Nos. 1831, 1832 and 1833—combined last Sunday with similar aircraft from the School of Naval Air Warfare in an attack on R.N.A.S. Culham. One phase of the strike is seen. The exercise was an impressive success, and reflected great credit on the Navy's "V R" units, for which ex-Naval maintenance (Air) ratings are urgently needed. A report of the attack will appear in our next issue.



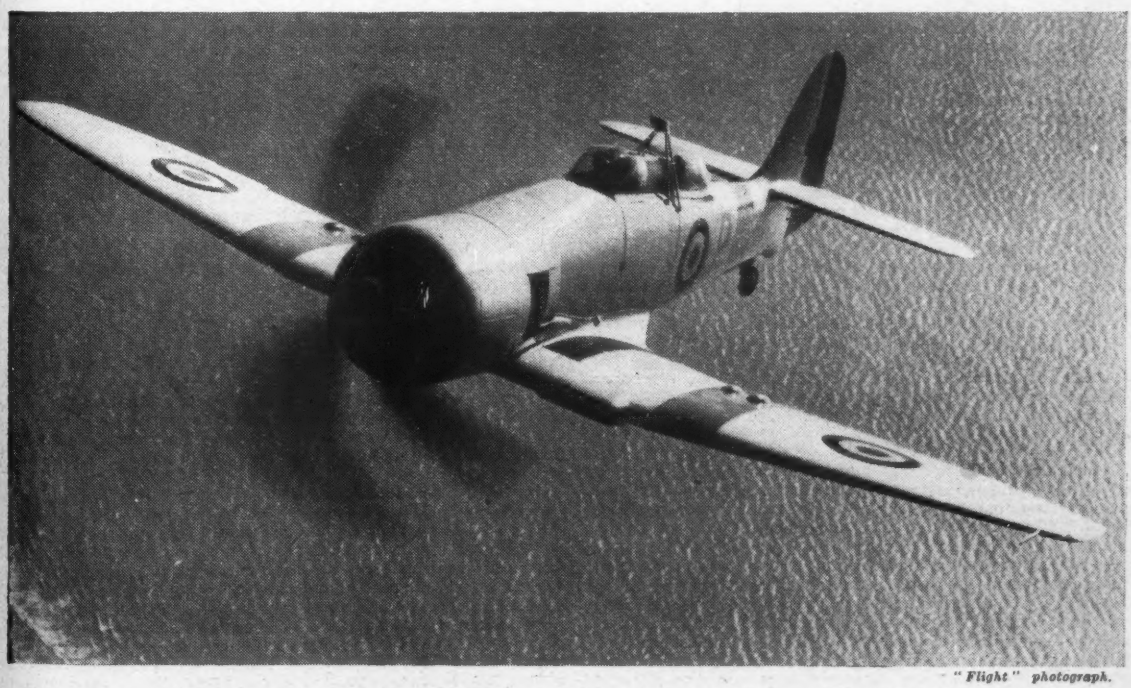
Gloster Meteor 4 fighters (2 Rolls-Royce Derwent 5) en route to the Netherlands. Two are being flown by Gloster pilots; the remainder by personnel of the Netherlands Army Air Force.

"Group" Activities

Hawker and Gloster Aircraft in the News

A PISTON-ENGINED Naval trainer, capable of 445 m.p.h., and having a range of 1,630 statute miles, is the subject of the *Flight* camera study at the foot of this page. Known in the Royal Navy as the Sea Fury T. Mk. 20, this newest development of the Sea Fury F.B.11 already in operation service, has been built to meet the need for advanced training, under the supervision of an instructor, to simulate the flying and handling characteristics of high-speed fighter-bombers. Every endeavour has been made to duplicate standard Sea Fury features; folding wings, deck-landing equipment, R.A.T.O.G. provision and two 45-gallon or 90-gallon drop tanks are specified. The armament load (additional to two 20mm guns, with 70 rounds apiece) can be two 100/1,000-lb bombs, two 500-lb depth charges, or twelve rocket projectiles.

Provision of a Perspex "tunnel" between the two cockpits has not prohibited the fitting of a gunsight for the instructor. The external pylon, visible in our photograph, holds a forward-inclined mirror, forming a periscope in conjunction with the sight itself, and enabling the instructor to "sight" over the head of his pupil. Coupled with the field of view afforded from the rear seat, this has



"Flight" photograph.

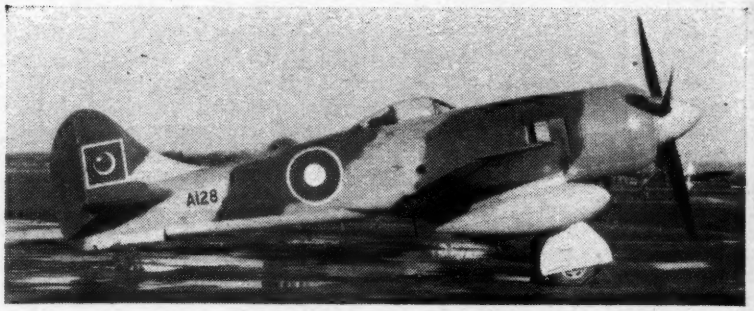
The prototype of the Sea Fury T. Mk. 20 dual-control Naval trainer (Bristol Centaurus 13) is seen near Hayling Island in the hands of Hawker's "Wimpey" Wade.

Group Activities . . . .

rendered unnecessary the raising of the instructor's eye level, with beneficial, aerodynamic (and, be it said, aesthetic) results.

A simple conversion of the Sea Fury trainer provides a land-based aircraft similar in general type to the version supplied to the Iraqi Air Force, though this particular model was fitted with an earlier form of cockpit enclosure.

Notwithstanding the widening adoption of jet fighters, the versatile, highly manœuvrable Centaurus-engined Sea Fury and Fury trainers continue to command the attention of Service authorities. Jet trainers have, nevertheless already "arrived," and from one of these—a Gloster Meteor T. Mk. 7—Mr. Cyril Peckham was able to secure the view of Meteor Mk. 5 single-seat fighters on their delivery flight to the Netherlands. The eight Meteors took off from the Gloster airfield at Moreton Valence and flew to Manston, for Customs clearance, in two " vics," led by Messrs. Dryland and Cooksey, Gloster test pilots. The other pilots were Royal Netherlands Air Force personnel.



A handsome Hawker Tempest 2 fighter-bomber (Bristol Centaurus engine) for the Pakistan Air Force. The maximum speed is 440 m.p.h. at 16,000 ft and the time of climb to 20,000 ft is 5.6 minutes. Bombs, or R.P.s are alternative loads to the drop tanks.

A third photograph depicts a Centaurus-powered Hawker Tempest 2 fighter-bomber for the Pakistan Air Force. Similar machines are being delivered to the Royal Indian Air Force The Tempest 2 is still employed by the Royal Air Force for fighting and ground attack.

Technical Functions of the S.B.A.C.

Standardization of Components and Procedures : Airscrew Performance Estimation

SO much is heard to-day of the need for standardization—it frequently follows, almost in the same breath, the call for increased production and reduced production costs—that one is apt on occasions to think of the virtues of standardization as newly discovered. This is, of course, far from being the case; the aircraft industry has long been in a position to profit from the advantages to be derived from standardization of certain classes of components. However, no sweeping statement concerning the desirability of standardization can be made, for there must be certain reservations. In the words of the Society of British Aircraft Constructors, " Standardization in the aircraft industry has its own particular problems, and experience and care are essential in deciding which items are suitable for standardization and which must be left severely alone if the designer is not to be unduly restricted in his continual quest for increased performance"

The successful activities of the Society towards promotion of standardization, not only of selected components but also of techniques, work which has extended over a period of about 11 years, are well known and appreciated within the inner circle of the British aircraft industry. It is now deservedly receiving wider credit and publicity.

When the S.B.A.C. first gave attention to the subject of standardization in 1938, its chief purpose was to bring about a reduction in design time, and to assist production and maintenance through the use of the maximum number of standard parts in a new aircraft design. The Society realized at that time that the support and enthusiasm of designers in the industry was essential if a range of standards was to be a success. This premise has remained the keynote of the Society's standardization activities. Unlike the procedure followed, for example, in America, the principle has been adopted that no design should be included in the standard range unless it has the full support of all interested members.

Since 1939 the S.B.A.C. has held regular monthly meetings at which all airframe designing companies are represented, and at less frequent intervals similar meetings are held to deal with matters concerning engines, airscrews, hydraulics and electrics. The procedure is, that each member in turn accepts responsibility for the developing of a new standard to the project stage. This is then circulated for study by the full committee, and after further discussion a final version acceptable to all concerned is adopted. Between five and six thousand standard parts have been agreed upon in this way. As a result, individual companies have been able to dispense almost entirely with the extensive ranges of company standards which they had previously to maintain. Moreover, the work does not end here, for the S.B.A.C. has been able to arrange for the manufacture of almost every standard part agreed upon. Drawings are published in the Standards Handbooks, and the names and addresses of suppliers, with times for delivery of prototype and production components, are included.

Complete sets of S.B.A.C. Standards Handbooks, containing five to six thousand items, have been circulated to no fewer than 850 subscribers. The Handbooks are available to all countries, and so far Australia, Canada, South Africa, India, U.S.A., Holland, France, Norway, Sweden, Pakistan and the Argentine have availed themselves of this service.

In addition to the standard designs for small parts, complete components such as pilot seats, rudder bars, trim control units, etc., have been introduced, and it is noteworthy that, except for special-purpose proprietary designs, every aircraft rivet produced in this country at the present time is to an S.B.A.C. standard.

A rather different field of the work is that concerned with standardization of systems and procedure. Examples are the S.B.A.C. standard drawing office system and the projected S.B.A.C. standard wiring system (including a draughtsman's electrical handbook).

Plastics—Moulding and Bulk

Worthy of separate mention is an innovation, reported to be working well, whereby the Society purchases moulding dies for the production of standard parts in plastic materials. After approval of the products, members may purchase bulk supplies at a price which includes a very small on-cost as a contribution towards tool charges. In this connection it may be remembered that the S.B.A.C. have reviewed plastic materials likely to be of use to the aircraft industry, grouped them on a basis of mechanical properties, and given each an appropriate S.B.A.C. reference number. This has been most helpful in overcoming the difficulties resulting from the use of proprietary names, many potential users having previously only limited knowledge of alternatives.

One of the best-known tasks in the field of standardization undertaken by the S.B.A.C. is that concerned with airscrew shafts. All manufacture in this country is controlled, and drawings are issued by the Society. Standards already provide for contra-rotating types of airscrews in all sizes required for engines at present in use, and there are indications that other countries, particularly France, may conform to these standards.

The issue of material specifications is, of course, primarily the work of the British Standards Institution, but the S.B.A.C. has an important part to play in this connection, and has undertaken much preliminary investigation in its own Materials Committees. Moreover, the protection of materials has been given special attention, and either in office data sheet or

wall chart form, recommended protective treatment for all classes of materials have been made available to the industry.

A new work of considerable importance now available from the Society at a cost of £2 (the price to cover subsequent amendments) is that concerning a standard method of "Propeller Performance Estimation." In the past, discrepancies have existed in the quotation of estimates by various producing companies, caused largely by basing their calculations on different methods and fundamental assumptions. In addition to its value as a standard, this new standard method will result in a great saving in calculation time. It has been estimated that 10 to 15 minutes should be sufficient to enable a comparison to be made for a given condition. The average time for calculations for a series of conditions should be shorter.

To quote two more examples as a final indication of the wide range of work upon which the Society is engaged, mention should be made of the present study, in conjunction with the A.R.B., of the airworthiness requirements of helicopters for the granting of certificates of airworthiness, and of the preparation of a standard formula for the estimation of the economics of civil air transport operation—the latter, a most formidable task.

F.A.I. Rules for Point-to-Point Records

IN the January issue of the Royal Aero Club Gazette are published details of the rules governing Point-to-Point Record flights. The Fédération Aéronautique Internationale recognises as records for such flights the shortest time taken by any pilot flying between capitals of two countries which are members of the F.A.I., or between certain capitals of Dominions, Colonies, Protectorates and Dependencies affiliated to the Royal Aero Club of the United Kingdom, irrespective of the size of the aircraft or the number of crew and passengers.

The rules governing these records lay down that the F.A.I. shall approve the course for point-to-point records and that the pilot and crew shall possess current F.A.I. Competitor's Annual Licences. For an attempt to be considered as a record the speed must be not less than 160 km.h., and any previous record must be exceeded by a margin of at least 1 per cent. The distance flown must be equivalent to or greater than the official distance (Great Circle route) between the recognized centres of the two capitals or cities in question. Airfields chosen for start and finish must be within 50 kms. of the centres of the capitals or cities concerned, but the times of the start and finish are taken as the aircraft, in flight, crosses the starting and finishing lines on the airfields.

In the inter-capital class, three separate Point-to-Point Records are obtainable in each approved course; outward, out-and-return, and inward. It is possible for a contestant attempting an out-and-return record to establish at the same time the outward and inward records. To permit direct visual observation by official timekeepers, contestants must cross starting and finishing lines at a height of not more than 100 metres and this applies also to the maximum height at which the turn must be made when attempting an out-and-return record. Apart from these provisions the attempt may be made at whatever altitude the pilot chooses. It is also laid down that the contestant must fly level for at least 1,000 metres before crossing the starting line. The special conditions applying to point-to-point records allow refuelling in the air and repairs to, or replacement of, parts of engine(s) and airframe. Changing of engine(s) or airframe, however, is prohibited and any time spent on the ground between starting and finishing lines counts as flying time. The official distances between centres or capitals or cities will be provided by the Royal Aero Club on application. Full details of the rules are also obtainable from the Secretary-General, The Royal Aero Club of the United Kingdom, 119, Piccadilly, London, W.1.

GHOST-VAMPIRE TIMES TO HEIGHT

BESIDES enabling Mr. John Cunningham to capture the world's altitude record with a climb to 59,446ft, on March 23rd last year, the installation of a D.H. Ghost turbojet in an early Vampire Mk. I airframe has produced some excellent time-to-height figures, which have recently been released. Flying this aircraft, TG 278, on January 31st, 1948, in preparation for the record flight, Mr. Cunningham climbed to 56,500ft in 23 min 50 sec; 40,000ft was reached in 7 min 45 sec, and 50,000ft in 13½ minutes.

These figures were obtained before "278" had been lightened, and its span increased, for the record flight—the take-off weight was, in fact, 8,997lb, 597lb heavier than at the time of the record attempt. The pilot was using 83 per cent of maximum static thrust, and the climb was begun from sea level at best climbing speed without high initial forward speed.

Although the original Ghost-Vampire combination was conceived solely for experimental purposes, the aircraft's performance at very high altitudes suggests that D.H. interceptor design will benefit considerably from trials of the now-historic "278," stated to be "continuing actively" at Hatfield, together with "vigorous development" of the Vampire airframe.

U.S. LIGHT HELICOPTER

THE Rotor-Craft XR-11, designed by Mr. Gilbert Magill, is so far the only tandem rotor helicopter to have flown with rigid blades, and it is claimed that inherent stability has been built into the design without resorting to the use of auxiliary aerofoils or gyroscopic weights. It has been under development for the U.S.A.F. for some three years and is at present being tested at the Cal-Aero Technical Institute at Glendale, California.

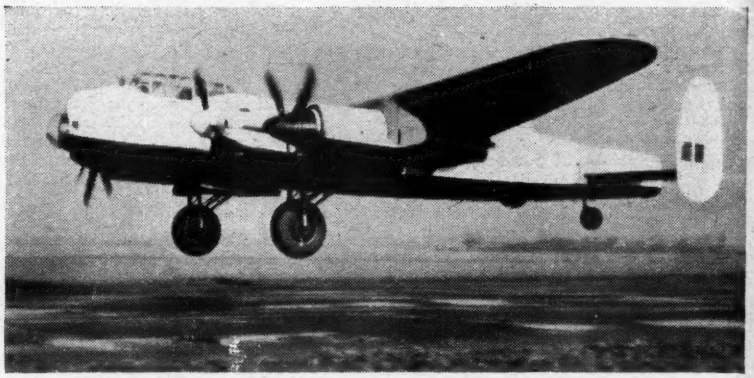
The most interesting feature of the XR-11 is the rigid mounting of the rotor blades, without hinges or flapping joints, the rotor discs constantly remaining perpendicular to the shafts and following broadly the principle of the controllable-pitch airscrew. Pitch control rods are enclosed in hollow drive shafts, resulting in a very clean assembly. The blade roots embody levers, which enter the hollow drive shafts via slots, connecting with their respective pitch control rods; the two three-bladed oppositely rotating rotors are mounted in tandem and overlap, the forward rotar turning anti-clockwise and the aft rotor turning clockwise. It is of interest to note that c.g. location is some 40 per cent to the rear of the forward rotor shaft, which is therefore carrying some 50 per cent greater disc loading than the rear shaft.

Swashplates for cyclic and collective pitch changes are positioned at the bases of the rotor drive shafts, eliminating a number of components normally used for transferring control movements. Mr. Magill claims that the control system is extremely sensitive and the lag in control response is almost imperceptible. A number of standard automotive parts are incorporated in the structure, reducing initial costs and maintenance time. The clutch and gears in the rotor assembly are reworked Ford units, a Studebaker free-wheeling unit is employed and all the universal joints are standard car accessories.

Welded steel-tube construction is used for the fuselage and the rotor blades are of laminated birch construction. The engine is a 110 h.p. Continental C-100 flat four; gross weight is 1,350 pounds; and disc loading is 2.3/lb/sq. ft. Production largely depends upon whether an Air Force contract is forthcoming, but the Company hope to enter the commercial field with a 2-seater, and estimate that the initial price in the case of a series of 500 machines would be £2,500 each, followed by a sliding scale to £1,250.

"Rolls so fast, he blacks out one eye at a time."

HERE AND THERE



PYTHON LANC: *The first flight of this Lancaster, fitted with two Armstrong Siddeley Python turboprops in the outboard positions was made on January 3rd. The Python, one of the most powerful units of its kind in the world, develops over 4,000 equivalent horse power.*

Proteus Development

THE existence of a sub-type of the Bristol Proteus turboprop, designated Proteus B Pt 3, may now be reported. Eight Proteus units, grouped in pairs, will power the Bristol Brabazon II.

Dr. Hooker Joins Bristols

BRITISH aviation circles will be interested to learn that Dr. S. G. Hooker, O.B.E., B.Sc., D.I.C., D.Ph., A.F.R.Ae.S., has joined the Bristol Aeroplane Co., Ltd. He is, of course, especially known for his work on gas turbine development.

Australian Gliding Record

ON Christmas Day Mr. Martin Warner, who in 1946 secured the height record for gliders in Australia with an altitude of 12,600 feet, made the longest return flight for a glider in Australia. He flew a Slingsby sailplane from Parkes to Yarrabundai and back, a distance of 39 miles, in five hours and reached a height of 9,200 feet.

Industrial Psychology

IN co-operation with the National Institute of Industrial Psychology, Henry Hughes & Son, Ltd., have instituted a series of six psychological aptitude tests designed to assess the intelligence, theoretical-mechanical and manipulative ability of boys between the ages of 15 and 18 years who apply for training under the five-year apprenticeship scheme in operation at the firm's Barkingside works. Preliminary statistics show that 76 per cent of the Hughes students have been successful in recent examinations.

U.S. Navy Orders

THE U.S. Navy has placed a three million dollar order (£750,000) for the largest blimp in the world, which is to have a length of 324ft and a width of 71ft. This is to be used for patrol work and will be about twice as large as those used on anti-submarine patrols during the war. Other Navy orders, which total over £18,000,000, include 120 night fighters (probably Douglas Skyknights), 16 two-seater jet trainers (probably TF-80C Shooting Stars) and nine helicopters.

Plessey Cartridge Starters

MANY applications of cartridge starting of internal combustion engines are described in a twenty-page illustrated brochure published by the Plessey Company of Ilford. Widely known as the Coffman starter during the war, the Plessey cartridge starter's peace-time uses include starting of light aircraft engines, lifeboat engines (as mentioned in a brief description of the smaller Plessey starters which appeared in *Flight*, May 6th 1948), marine auxiliaries, stationary engines, such as those used to drive excavators, compressors and electrical generating plant. The booklet also contains technical descriptions of the various models with dimensioned sketches and tabulated data.

Gliding Certificates

FIGURES recently issued by the British Gliding Association through the Royal Aero Club show that in 1948 a total of 14,394 gliding certificates were issued, an increase of 2,904 over the 1947 total, which was 11,490. The 1948 figure can be broken down indicating the number of A, B, and C certificates which were, 9,453, 3,194, and 1,747 respectively. During the two months September and October, 1948, a total of 381 A certificates were issued, 288 to the A.T.C.; 63 to civilian clubs and 30 to Service clubs. The number of B certificates issued in those months was 112, 24 to the A.T.C. 54 to civilian clubs and 34 to Service clubs. Of C certificates, 92 were issued, made up of 22 to the A.T.C., 41 to civilian clubs and 29 to Service clubs.

Model Records

TWO new international model aircraft records claimed by Russia, have recently been confirmed by the Fédération Aéronautique Internationale. These are both model seaplane records, one for mechanically powered craft and the other for rubber-driven models. The new power-driven distance record was broken by the previous holder, Mikhail Vassilchenko, who, with a flight of 58.8 kilometres (36.5 miles), exceeded his former longest distance by 23 kilometres. The rubber-powered record was for duration and now stands to the credit of Anatoli Vassilyev with an airborne endurance time of 30 minutes 15 seconds.

It is interesting to note in the official list of international confirmed records up to January 1st, 1949, recently published by the F.A.I., that out of the 20 records for model aircraft (including gliders) 13 are held by the U.S.S.R., 3 by Hungary, 3 by France, and one by Switzerland.

R.Ae.S. Derby Branch

DERBY branch of the Royal Aeronautical Society has published its lecture programme for the 1949 spring session, together with the officers of this branch for 1948-49. Mr. E. W. Hives, C.H., M.B.E., F.R.Ae.S., is the president and Mr. A. G. Elliott, C.B.E., F.R.Ae.S., is chairman. The two vice-chairmen are L. F. R. Fell, D.S.O., O.B.E., F.R.Ae.S., and A. A. Rubbra,

FUTURE AIR AMBULANCE ? : *The Bristol 171 put in an appearance at the Brize Norton casualty evacuation demonstration described in this issue. Test equipment prevented installation of the three stretchers which can be carried, but the 171's flying qualities suggested suitability for the work.*

HERE AND THERE

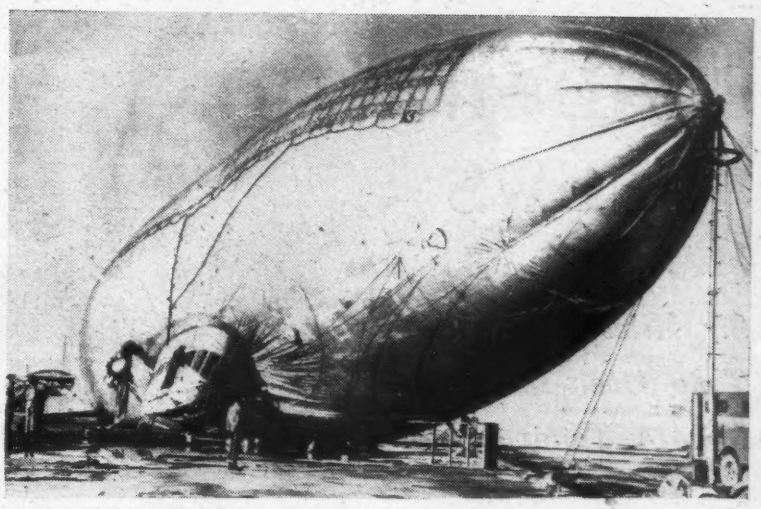
F.R.Ae.S. The hon. secretary and hon. treasurer are J. L. Batchelor, A.R.Ae.S., and C. A. Davies, A.F.R.Ae.S., respectively. The committee consists of the following: C. L. Hinings, O.B.E., A.F.R.Ae.S.; P. A. Marks, Stud. R.Ae.S.; F. Nixon, F.R.Ae.S.; and R. H. Peacock, A.F.R.Ae.S.

Model Trophy Presentation

FOR the best all-round performance in the Isle of Wight Branch of the Air League of the British Empire model flying rally, held on Oct. 3rd, 1948, Mr. V. Woodward, of the Solent Heights Model Flying Club, was awarded the branch'es model trophy. The presentation of the trophy to Mr. Woodward was made on January 10th at Saunders Roe, Ltd., by Mr. R. V. Perfect, a director of the company. Mr. J. E. Raddings, hon. secretary of the branch, Mr. J. Fairley, Councillor A. H. Turner and A. Cdre. F. W. Walker, D.S.C., A.F.C., hon. treasurer, were among those who attended.

S.M.A.E. Subscriptions

TO clarify a certain amount of misunderstanding which, according to the Society of Model Aeronautical Engineers, has arisen regarding the question of increased subscriptions, it is pointed out that the proposed increase to 10s per year was a recommendation put forward by the finance committee at the recent annual general meeting. The recommended increase was, however, not accepted at the meeting and no such increase is to be introduced. Other means of balancing the Society's budget are being investigated in order to meet the rapid expansion of activities.



TAKING IT LYING DOWN: A heavy snowfall in Los Angeles recently resulted in an inch thick layer of snow settling on the top surface of this blimp used for advertising purposes. It became unstable at its moorings and was punctured when rolling about.

News in Brief

ON February 5th, the day of the Royal Aero Club staff dance, the Royal Aero Club and Londonderry House will be closed from 3 p.m. onwards.

* * *

The London office of Christie-Tyler, Ltd., has been closed and this company's aviation interests will be looked after by Mr. Michael A. H. Christie at a new branch office at Haddenham, Bucks (opposite the entrance to Thame airfield) or at the factory in Wales.

Mr. Andrew Blyth has resigned his appointment as sales manager of High Duty Alloys, Ltd., and has become general manager of William Mills, Ltd., aluminium alloy founders, of Wednesbury, Staffs.

* * *

J. Manger and Son, Ltd., parent company of the Quickstryp Chemical Co., Ltd., this year celebrate their centenary. Since the foundation of the firm in 1849 it has grown from one warehouse in the City of London, to ten companies or works.

* * *

Owned and operated by Miss E. Rudnick, the Bakersfield Air Park, California, has been appointed distributor for the Hiller 360 helicopter in the principal agricultural areas of southern California and southern Nevada. The Hiller 360 is manufactured by United Helicopters, Incorporated.

* * *

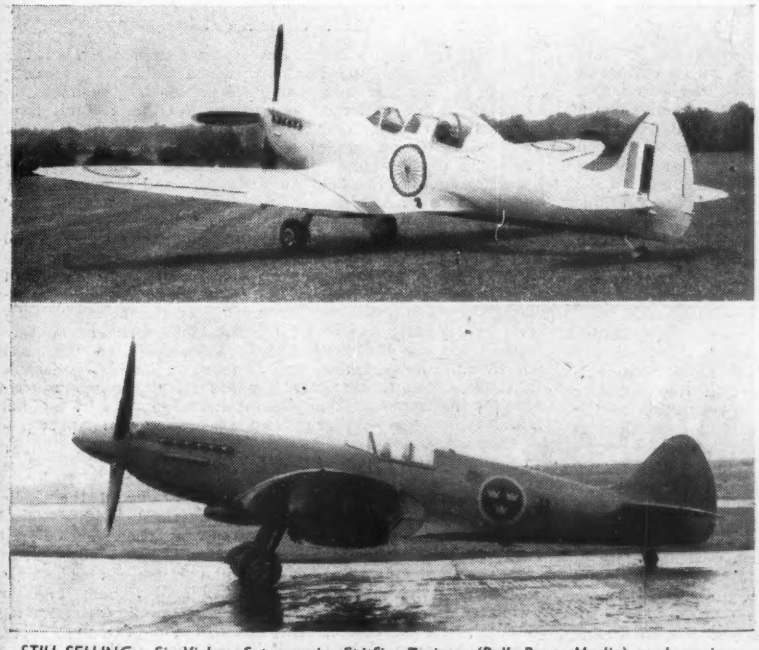
On January 24th Mr. I. A. Brown was to leave Redhill airfield on a flight to Sydney in a Proctor III. He will investigate for Sponson Developments, Ltd., the potential market for the Tribian Mark I and II in countries on the route, and will report on operational conditions for amphibians and also on suitable agents.

* * *

A performance of Terence Rattigan's play, *Flare Path*, will be given on February 3rd at the Fortune Theatre, London, at 7 p.m. The proceeds are to be given to the Forces Help Society and Lord Roberts Workshops. Tickets priced from 3s 6d. to 12s 6d are obtainable from the Appeals Branch, 37, Thurloe Street, S.W.7.

* * *

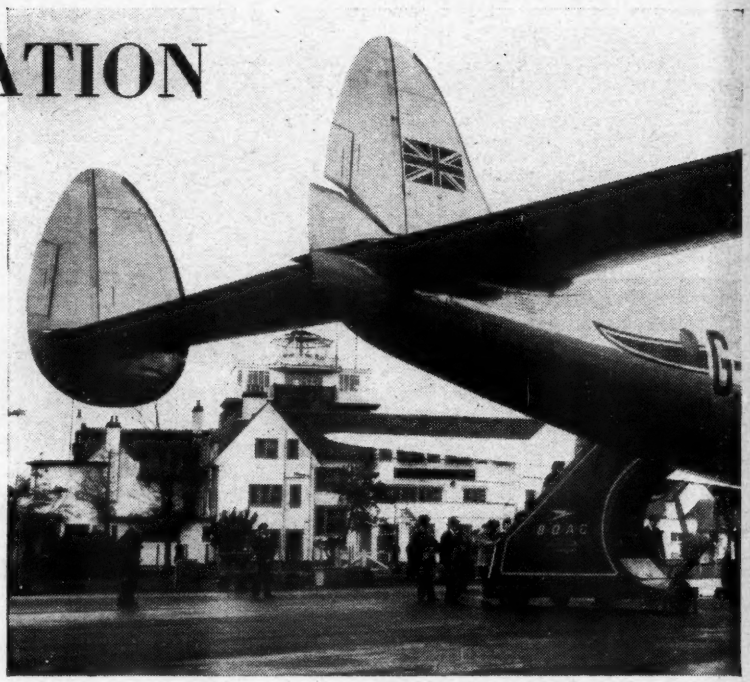
Engineer officer E. D. Gilbertson, of B.O.A.C., has recently completed 250 flights across the Atlantic. An ex-Halton R.A.F. apprentice, engineer officer Gilbertson served in Coastal Command during the war and also flew in Liberators on the return ferry service across the Atlantic. The only other B.O.A.C. aircrew member to have completed over 250 crossings is Capt. W. L. Messenger.



STILL SELLING: Six Vickers-Supermarine Spitfire Trainers (Rolls-Royce Merlin) as shown in the upper view, have lately been supplied to the Royal Indian Air Force, and Sweden has acquired twelve Griffon-engined Spitfire P.R. Mk. 19s (lower). The Swedish machines have a maximum speed of 445 m.p.h. at 26,000ft and, using only 27 per cent power, cruise at 280 m.p.h. At 360 m.p.h. the still-air range, after allowance for take-off, climb and 15 minutes at full power, is 1,400 miles.

CIVIL AVIATION NEWS

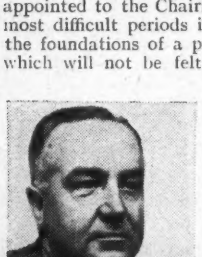
Sir Miles Thomas to Take Over B.O.A.C.: B.S.A.A. Tudor IV Lost in Caribbean



SCOTTISH TERMINAL : The main Atlantic operators use Prestwick Airport with Constellations, Canadair Fours, DC-4s and DC-6s. This Airport is the fourth busiest in the U.K. in terms of scheduled aircraft arrivals and departures.

B.O.A.C. CHAIRMAN

SIR HAROLD HARTLEY'S resignation, at his own request, from the Chairmanship of the British Overseas Airways Corporation when his present term of office comes to an end on June 30th this year, has been accepted by the Minister of Civil Aviation. He was Chairman of Railway Air Services from 1934 until he joined B.O.A.C., when he took charge of the European Division before B.E.A. was created. On August 1st, 1946, he became Chairman of B.E.A., and one year later was appointed to the Chairmanship of B.O.A.C. During one of the most difficult periods in the Corporation, Sir Harold has laid the foundations of a policy, and made decisions, the effect of which will not be felt until some years after his retirement.



Sir Miles Thomas.

Sir Miles Thomas, at present Deputy Chairman, has been invited by the Minister of Civil Aviation to succeed Sir Harold Hartley, and Mr. Whitney Straight, who will continue to be Chief Executive of the Corporation, will succeed Sir Miles Thomas as Deputy Chairman. This combination of duties, in itself, constitutes a minor economy. Incidentally, there is understood to be no foundation in the suggestion, made elsewhere, that Mr. Whitney Straight was, until recently, the Chairman-designate. It has always been understood that Mr. Straight's prime interest was in the executive sphere and that a promotion to the Chairmanship would not enable him to remain in direct control of operations and responsible for the new aircraft programme.

The Chairman-designate succeeded Sir Harold Howitt as Vice-Chairman on March 31st last year, and became specially responsible for questions of organization and problems connected with the Empire routes. In September it was announced that he had assumed responsibility for implementing B.O.A.C. plans for reorganization. There is unlikely to be any change in policy or plans as a result of the new appointment, since results of the reorganization, which was put into effect at the beginning of August last year, are already evident in greater capacity ton miles. This has been achieved partly through more efficient organization and the reorganization of duties throughout the Corporation. This will undoubtedly influence the Corporation's accounts for the current year. At the same time there has been a steady decline in the staff employed to a little less than 20,000. Sir Miles Thomas is also Director of the Government Colonial Development Corporation, in connection with which he left England on January 18th by B.O.A.C. Solent flying boat to visit the Rhodesias and Nyasaland. Since he took office as Deputy Chairman he has visited America to study American operation and to see the Stratocruisers under construction at the Boeing factory. In June last year he visited Colombo to discuss agreements for a U.K.-Ceylon service, and in November Sir Miles Thomas again visited the U.S.A.

AIR CHARTER

THERE has been a recent development in live stock traffic including pigs and chickens, which indicates increasing interest in that direction, and it is hoped that business will eventually grow to larger proportions.. Other fixtures have included the carriage of bullion from Switzerland to Bulgaria by several Ansons and of a ship's crew from Liverpool to Port Said in a Dakota. Offers have been made to fly fruit from Evesham to Sheffield for £17 a ton and charterers have offered £170 for carrying 3,200 kilos of mimosa from Nice to London. An interesting charter was flown by Air Transport (Charter) (C.I.) when 2,000 tons of diesel oil was carried to the Island of Alderney in an emergency. Other enquiries have come from passengers for small and medium aircraft for winter sports in Switzerland. The Paris Air Freight exchange has been quiet. An interesting experiment was recently conducted jointly by the United States Department of Agriculture and the Lockheed Aircraft Corporation on the effect which air transportation would have on highly perishable fruit. It was found that pressurization equipment was unnecessary for the transportation of fruit and vegetables by air, but humidity and temperature control appeared to be of importance.

"STAR ARIEL" MISSING

ON Monday, January 17th, *Star Ariel*, one of the Tudor IV's operated by British South American Airways, failed to arrive at its destination, Kingston, Jamaica. The aircraft took off from Bermuda at 12.25 hours G.M.T., 08.25 hours local time, carrying 13 passengers and a crew of six. The flight was planned to be made at an altitude of 18,000ft and the estimated time of arrival was 5 hours 25 minutes after leaving Bermuda. Fuel was carried sufficient for 11 hours' flying. Weather reports at the time indicated good conditions for the whole journey and it has since been confirmed that the actual weather corresponding with those forecast. Normal communications with the ground were maintained for the first hour and at 13.37 hours G.M.T., 09.37 hours local time, a routine position report was passed. No subsequent signals were received

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from that aircraft. When the aircraft became overdue the Air Sea Rescue organization was alerted and put into operation. In addition, the facilities at once made available by the authorities of the U.S.A. together with all available aircraft of B.S.A.A. and its local associates and of B.O.A.C. took part in the search which, at the time of going to press, had yielded no positive results. The Corporation decided that in addition to the normal overhaul and maintenance procedures a special examination of each individual Tudor IV aircraft now in service should be carried out. This decision will involve the suspension of the Corporation's Tudor fleet from operations for the time being. The Minister of Civil Aviation has invited Lord Brabazon to take charge of this special investigation and his terms of reference are to enquire into the design and construction of Tudor IV aircraft in relation to safety and airworthiness and into any other relevant matters. The crew of *Star Ariel* were: Captain J. C. McPhee, 1st Officer F. Dauncey, 2nd Officer V. D. Shapley, Radio Officer G. Rettie, Steward K. W. Coleman and Stewardess P. B. Moxon.

BREVITIES

SAUNDERS-ROE, LTD., have announced that the SR/45 flying-boats, the first of which is expected to make its initial flight in 1950, will be known as the Princess class.

* * *

Passenger and cargo sales for 1948, recently announced by Pan American Airways, totalled £32,500,000, an increase of 24 per cent over 1947. During the year 907,000 passengers were carried by the airline.

* * *

The Conference of I.A.T.A. members arranged for 11th and 12th of January, to discuss air traffic control at Zurich-Kolten and Geneva-Cointrin airports, lasted only one day. Little progress can be made until the radio equipment is delivered from America.

* * *

Preparations for increasing facilities for British tourists are being considered by the French Tourist Trade and Air France has announced an increased service between London Airport and Dinard, Brittany. A daily service will be flown by Languedoc 33-seater aircraft and the journey will take about one hour. The return fare is £11 11s and excursion tickets will be valid for fifteen days.

* * *

K.L.M. introduced Convairs on the London-Amsterdam service on January 17th. At the same time, these aircraft will go into service between Amsterdam, Paris and Stockholm. With a cruising speed of 300 m.p.h., the flight between London and Amsterdam will take 1 hour 20 minutes, cutting 20 minutes off the present schedule.

* * *

From January 1st the Scandinavian Airlines System started business as a registered British company, S.A.S., Ltd. No changes have been made in personnel and the address of the company is still 16, Upper Grosvenor Street. As reported in *Flight*, July 1st, 1948, the Chairman of the new company is Mr. Denis H. Handover and the other directors are Mr. C. E. Kilhlstedt, Mr. H. P. T. Lind and Mr. A. Martens respectively representing A.B.A., D.D.L. and D.N.L.

* * *

Officers and Executive Committee of the British Air Charter Asscciation for the year 1948/49 are: Chairman, Mr. J. E. Rylands, Lancashire Aircraft Corporation, Ltd.; Vice-Chairman, Mr. D. L. Eskell, Morton Air Services, Ltd.; Treasurer, Captain, G. P. Olley, Olley Air Service, Ltd. Regular informal gatherings at Londonderry House are being arranged for members to allow matters of general interest to operators to be discussed.

* * *

The Southern African Air Transport Council will meet at Pretoria on February 22nd. The delegation from the United Kingdom which will be led by Sir George Cribbett, will meet delegations from areas in Southern Africa. The conference will be primarily concerned with reviewing the operation of plans drawn up at the Cape Town Conference in 1944 for the integration of trunk, regional and local air services, and with progress in the development of the route organization on the Springbok route. In addition, there are a number of technical matters to be discussed, mainly bearing on aspects of the requirements of the route organization.

* * *

Continuing their policy of reducing the cost of air travel, Pan American Airways, in conjunction with National Airlines and Eastern Air Lines, are now operating round trips between the Caribbean islands and towns on the Atlantic coastline at reduced fares. In some cases the reduction amounts to as much as £25.

* * *

In West Australia, a new company, known as Air Beef, Ltd., has been formed to carry carcases from the station properties in the Orde River district, to Wyndham. It is intended that cattle shall be killed on the property and then flown some 200 miles to the meat works for freezing. The scheme is experimental, but in view of losses of weight and casualties suffered by surface transport, the prospects are thought to be hopeful.

* * *

Aer Lingus London booking office moved to Dorland Hall, Lower Regent Street on January 22nd. The present premises at 221, Regent Street will continue to function as a supplementary passenger booking and ticket office. The Company has established a garage at Dublin Airport for passengers who wish to leave their cars at the airport whilst away. By arrangement, motor cars will be collected and garaged at Colinstown for a small charge.

* * *

British Aviation Services have taken over the general agency for Air Malta, Ltd., in the U.K. Passengers may obtain all tickets for Air Malta services from the London office at 1, Great Cumberland Place, and the normal commission rates of 7½ per cent for passengers and 5 per cent for freight are charged. Short notice reservations can be obtained providing the passenger is willing to accept telephone or cable charges involved.

* * *

Hastings Corporation have granted a 14-year lease of the Municipal Airfield site at Pebsham to Hastings and East Sussex Air Service, Ltd. Under the conditions of the lease the company will build a terminal building providing accommodation for Customs, a restaurant, control room, flying club and

"Flight" photograph.

INTERNATIONAL AIRPORT: On the wide tarmac at Schiphol Airport, Amsterdam, Douglas aircraft operated by airlines of several nationalities are predominant. The white aircraft on the left is a United Nations Dakota and in the centre, behind the Dutch DC-4, is a similar aircraft operated by Philippine Air Lines Inc. One of the K.L.M. Convairs is taxying out at right. Also on the right can be seen the all-wood prefabricated hangars imported from Sweden.

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other facilities, a hangar for six aircraft and runways to take aircraft carrying eight passengers. It is hoped that the new airport will attract both Continental visitors and holiday air traffic from this country.

* * *

United Airlines, the U.S. domestic operator, flew 93,646,500 revenue passenger miles during December, an increase of 28½ per cent over December, 1947, and 6½ per cent over November, 1948. Air mail ton-miles flown broke all records and numbered 1,404,500, an increase of 57½ per cent over December, 1947, and 54 per cent over November, 1948.

* * *

In order to increase cargo capacity, Air-India International, Ltd., have modified the interior of their three Constellations. All sleeping berths, with the exception of four, have been removed from each aircraft and replaced by luggage racks. The refrigerators have also been considered surplus and removed.

* * *

Representatives from six member countries of the International Civil Aviation Organization have been chosen to receive training at the I.C.A.O. headquarters in Montreal in the working of the Organization. The new trainees, who are from Bolivia, Denmark, Dominican Republic, Haiti, India and Italy, will train for six months and then return to their own countries to assist in liaison work with I.C.A.O. This is I.C.A.O.'s second Trainee Programme, the first concluding last June and including trainees from Argentina, Bolivia, France, Greece and Netherlands.

* * *

Miss Jeanne Rougier-Watkins, an air hostess with Hunting Air Travel, Ltd., has logged well over 2,000 hours in the air. Much of this experience was gained in R.A.F. Transport Command during the war when she flew with the Air Evacuation Service bringing wounded troops from Africa and France in Dakota ambulances. Previously with an air charter company based in South Africa, Miss Rougier-Watkins now flies in Hunting's 24-seater Vikings. The company is operating charter flights from Bovingdon to East Africa on the Ground Nuts Scheme for the Overseas Food Corporation.

Miss Jeanne Rougier-Watkins.

* * *

Aircraft of A.O.A. flying on the Berlin airlift are now making 39 round trips a week between Berlin and Frankfurt, an increase of 14 trips a week over the December figures, and carrying 504 tons of cargo and 550 passengers a week. Services between Berlin and New York are unaffected by the airlift.

FROM THE CLUBS

THE South Coast Flying Club will hold its annual general meeting on February 12th at 7.30 p.m. After the meeting there will be a dance, for which tickets are available at 6s.

* * *

OWNERS of, and those responsible for, aircraft powered by Cirrus Minor engines are advised in the Cirrus Service Instruction sheet number J.19 that a small number of die-cast cylinder heads have developed cracks in the vicinity of the exhaust valve seats. No such cracks have been detected in sand-cast cylinder heads. The instruction calls for a 10-hour inspection of the die-cast heads with special attention to the area immediately below the exhaust side sparking plug adaptors. Sketches indicating the suspected locality, and means of identifying sand- and die-cast heads, accompany this instruction.

* * *

FLYING hours during December at the London Aeroplane Club amounted to nearly 93 hours, bringing the total number of hours logged during 1948 up to 1,826. Altogether 57 first solo flights were completed and 42 "A" licence tests passed in the year. Pilots intending to visit Panshanger are assured of a warm welcome and are reminded that the club is open every day except Mondays and Tuesdays.

Amongst those who have accepted invitations to attend the club's annual ball at the Savoy on January 28th are Mr. G. S. Lindgren, Parliamentary Secretary to the Ministry of Civil Aviation, Mr. P. G. Masefield, recently appointed assistant to the chairman of B.E.A., and Col. R. L. Preston, C.B.E., Secretary-General of the Royal Aero Club.

* * *

ON learning that the Royal Aero Club of Spain have once again invited members and associate members of the British Royal Aero Club to a Rally in Spain, and having noted that the dates follow on M. André's Deauville week-end, it was not surprising that many people would recognize and seize this opportunity for a first-class ten-day flying holiday. The Deauville Rally is to be held from July 2nd-4th and the Spanish Rally from the 4th-11th. A very large number of applications have already been received for both, and anyone else who has considered applying should do so at once.

Centre for assembly for the Spanish Rally is Barcelona on July 4th, and during the week that follows visits are planned to Valencia, Madrid, Jerez de la Frontera and Pamplona. The Royal Aero Club have, as usual, prepared maps and route suggestions for members flying from this country to Spain.

* * *

COMPARATIVELY few flying hours were possible at the Yorkshire Aeroplane Club in December owing to inclement weather, but social activities were well supported. At the third post-war annual ball at the Hotel Majestic, Harrogate, which was attended by over 300 members and guests, the Ronald H. Braine Navigation Trophy was presented to Mr. D. H. Wyatt, who won the contest with a marking of 96 per cent; the previous winner, Mr. C. G. Wheatley, was the runner-up. Four new members were elected during December. The winter rates continue until March 31st, and until that date the fee for flying membership is three guineas, and for non-flying members two guineas; the entrance fee of one guinea applies to both classes. The rates for Austers now in force are £3 10s per hour for dual and £2 10s per hour for solo flying.

Three evening gatherings are to be held in February. The first of these, on February 9th, will be a lecture by Mr. J. Taylor, head of the Shell Aviation department, on "A Pilot Reminisces on 33 Years' Flying," On February 16th there is to be a film show, including "How an Aeroplane Flies" and a coloured film of the 1948 Royal Command Performance. The R.A.F. Station, Church Fenton, have arranged to lend some combat films for the show on February 23rd.

* * *

A COMMITTEE meeting of the Orkney Flying Club was held at the Kirkwall Hotel on January 14th. Co-opted members of the Committee include Lt. Cdr. Ross, R.N.V.R., meteorological officer and local H.M. Customs and Excise Officer; Mr. Evans, H.M. Coastguard, and F/O. J. Walker. Assistance and co-operation has been obtained from Sir Basil Neven-Spence, M.P.; the Ultra Light Aircraft Association; the S.M.A.E., and the M.C.A. both at Inverness and London. Mr. Renwick, M.C.A. Airfield Commandant at Inverness, has advised that club aircraft will be able to operate from Hatston, where club rooms and hangar space can be provided from existing accommodation. The club is maintaining close touch with MacDonald Aircraft, Ltd., Kinross, regarding the purchase of aircraft for instruction and charter flying. Four sub-committees have been formed: finance and general purposes; flying training; junior section; and entertainments and hospitality. It is anticipated that there will be at least 200 members by the spring.

***SUMMER SCENE :** At a time when many people are making plans to take part in Continental air rallies during the coming summer, past memories and experiences are recalled. This photograph was taken during the Ostend rally last year.*

EXTERNAL TANKS

Modes and Methods of Carrying Extra Fuel

Gloster Meteor 7 demonstrator, complete with 180-gallon belly tank and two 100-gallon wing tanks.

NO sooner had fighters been "cleaned up" to the extent of shedding—aerodynamically speaking—an entire wing with its associated struts, and the complete undercarriage, than auxiliary fuel tanks began to appear like fungoid growths to mar their appearance and performance. For reasons not readily discovered (though technical and tactical considerations must have underlain them), the old R.A.F. and Fleet Air Arm fighter biplanes rarely operated with external tanks; in the years immediately preceding the monoplane era, however, a certain vogue for these aids was discernible among American "pursuit" and "attack" machines, notably those of Curtiss and Boeing origin.

The value of supplementary tanks on fighters was not truly appreciated in Great Britain until the war; even then, some of the first installations were made to extend the ferrying range rather than to increase tactical effectiveness. Typical of these was the fitting of two "ferry" tanks on the Hurricane for delivery flights across Africa to the Middle East. Once again, the U.S. Army and Navy, to whom range in a fighter had long been considered vital, gave a lead, their ambitious "drop-tank" schemes culminating in special installations for Mustang, Lightning and Thunderbolt escort fighters which, toward the end of the war, were penetrating hundreds of miles over enemy territory.

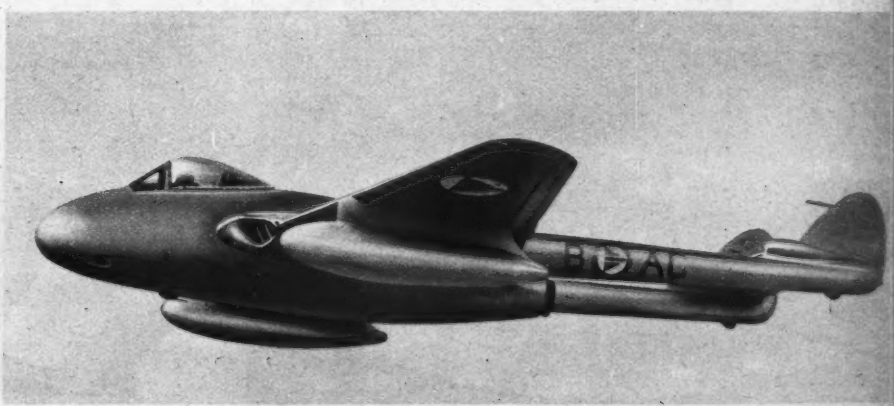
The coming of the jet fighter, with its voracious fuel demands, has led to further study of external tanks, and some of the more recent installations are depicted on these pages. Though fighters remain the principal class of military aircraft to which such tanks have been applied, these may also be seen to-day on attack and reconnaissance aircraft, and even on long-range "patrol bombers," one example of which—the Lockheed P2V *Truculent Turtle*—holds the world's record for distance in a straight line with a flight of 11,235 miles, from Perth, Australia, to Columbus, Ohio. On this occasion, of course, additional to the wing-tip tanks, the *Turtle* had extra internal tankage, and the total fuel load represented something like 1¼ times the empty weight of the aircraft. Rocket-assisted take-off was imperative.

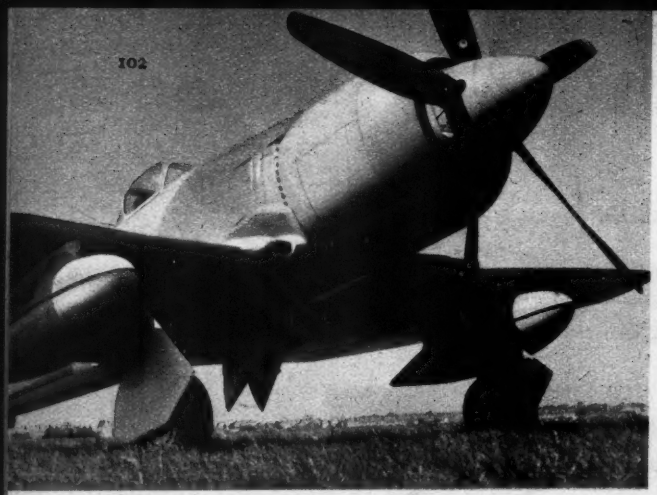
One of the first civil installations of drop tanks is that on the Beechcraft Bonanza, in which Capt. William P. Odom lately established a new light aircraft distance record of 2,375 miles.

The ensuing brief survey is concerned only with external tankage carried by, or towed by, aircraft, and takes no account of aerial refuelling from an independent tanker aircraft, a technique perfected in this country and lately extended to America. The merits and possibilities of this system have been the subject of frequent discussion.

Among the drop-tank installations depicted, those on

A D.H. Vampire 3, with 100-gallon wing tanks, leaves Hatfield for Norway.





The Hawker Fury carries its two 90-gallon drop tanks well inboard.

A Sea Mosquito with 50-gallon drop tanks on the folded wings

EXTERNAL TANKS . . .

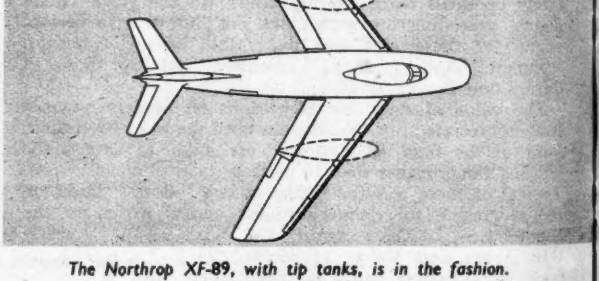
the Meteor, Vampire and Attacker typify the latest British practice. To extend the range of the Meteor—a relatively small aircraft with two powerful turbojets necessitated a very substantial increase in fuel supply. In part, the demand is being met by lengthening the forward part of the fuselage, but a 180-gallon jettisonable belly tank and two jettisonable wing tanks of 100 gallons each are supplied as optional equipment. The belly tank is slung below the main fuselage tank, to which fuel is transferred by air pressure tapped from the compressor casing of one of the Derwent turbojets, via float-type delivery valves. When all the fuel has been transferred, a warning light shows in the cockpit. A combined lever operates the air pressure and jettison release gear.

On the most recent marks of Vampire, the 100-gallon metal under-wing tanks are pressurized for fuel transfer by means of a vacuum pump. From these (as from the fuselage tank) fuel passes through a common collector box and filter to a gear-driven pump, and thence to a pressure fuel cock.

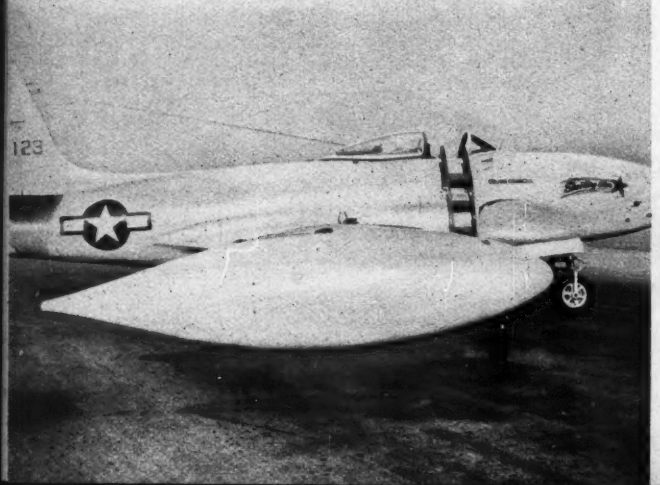
The largest external tank yet made in this country for a fighter is that of the Supermarine Attacker. This is of 270 gallons capacity and of fine aerodynamic form. A very carefully designed fillet secures a snug fit against the under-surface of the fuselage. The 180-gallon belly tank for the piston-engined Seafang naval fighter, as will be judged from the illustration, is of totally different design, being of "airship" form and mounted at a slightly nose-down angle to the line of flight. Provision is made under the wings of the Seafang, as in other Supermarine piston-engined fighters, for 45-gallon "combat" tanks, stressed, as

Republic F-84 Thunderjet, with full tankage.

Sweep-back necessitates inboard mounting of the F-86's drop tanks.

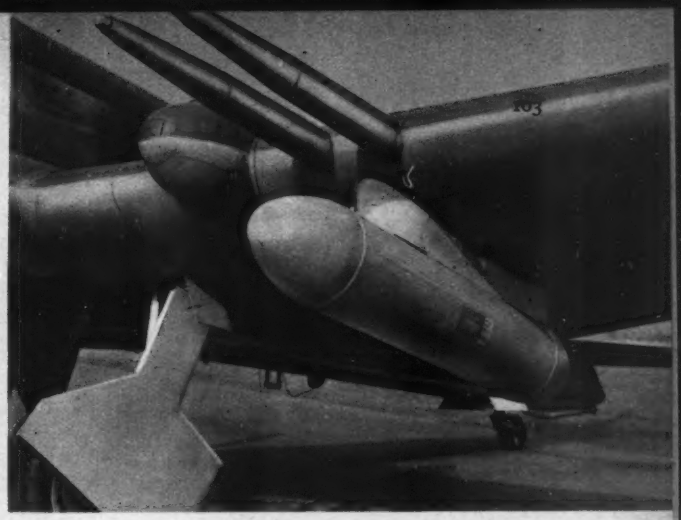


"Outsize" tip tanks on a Lockheed F-80 Shooting Star



The Northrop XF-89, with tip tanks, is in the fashion.

The Firefly's auxiliary tank (starboard wing) is balanced by a radome.



One of the characteristic drop tanks of the Blackburn Firebrand.

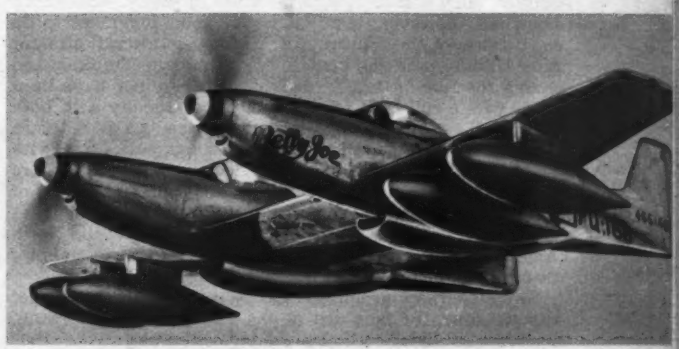
their name suggests, to withstand violent manœuvres.

Naval aircraft are more often to be seen with auxiliary tanks in place than without; the Fairey Firefly, in fact, almost invariably carries an auxiliary tank under the port wing, the corresponding excrescence on the starboard side being a "radome," though this fitting can, of course, be dispensed with in favour of a second tank. The maximum external fuel load of the Firefly is two 90-gallon drop tanks and two of 45 gallons.

Up to the present, no wing-tip drop-tank installations have been seen on a British fighter, though this location is very popular in America for fighters having no sweep-back. The first jet fighter to utilize tip tanks was the Lockheed F-80 Shooting Star, the unusual location being the outcome of wind-tunnel tests on eight types of tanks, having equal volume, to determine the optimum aerodynamic and structural position. The solution was complicated by problems of ground clearance, flap or aileron clearance, and the requirement for carrying 1,000-lb bombs as alternative loads. The final choice—an underslung wing-tip position—was chosen by Lockheed for the following reasons: (i) the drag increase at high speed with tip tanks was only 12 per cent of the aircraft profile drag, compared with 27 per cent for the P-38 (Lightning) "pylon" type installation, or 30 per cent for the "slipper" type. (ii) The tip position increased the effective aspect ratio from 5.5 to 9.9 by providing an end-plate effect on the wing. (Glide tests showed that the F-80 with tanks on, glided 92 miles with power off from 40,000ft, and 87 miles under the same conditions with tanks off.) (iii) The tip location had the minimum adverse effect on critical Mach Number. (The F-80A has flown at Mach Numbers over .75 with the tanks in position.) (iv) No jettisoning problem existed at the wing-tip. (v) With the exception of local wing-tip regions, the structural strength of the airframe was actually increased for all flight conditions as compared with the condition in which the tanks were removed. (This, it is stated, was due to the favourable dead-weight effect of the fuel.) (vi) Aileron effectiveness was increased considerably by the presence of the tip tanks, fully compensating for the increased moment of inertia in the rolling plane. (vii) Should extreme rates of roll inadvertently be developed, the wing-tip tanks would throw themselves clear without damage to the aircraft. (viii) While a centred position on the wing-tip gave better dihedral effect than the low position with equal drag values, the inability to carry standard bombs, and structural problems within the tanks themselves, outweighed this one advantage.

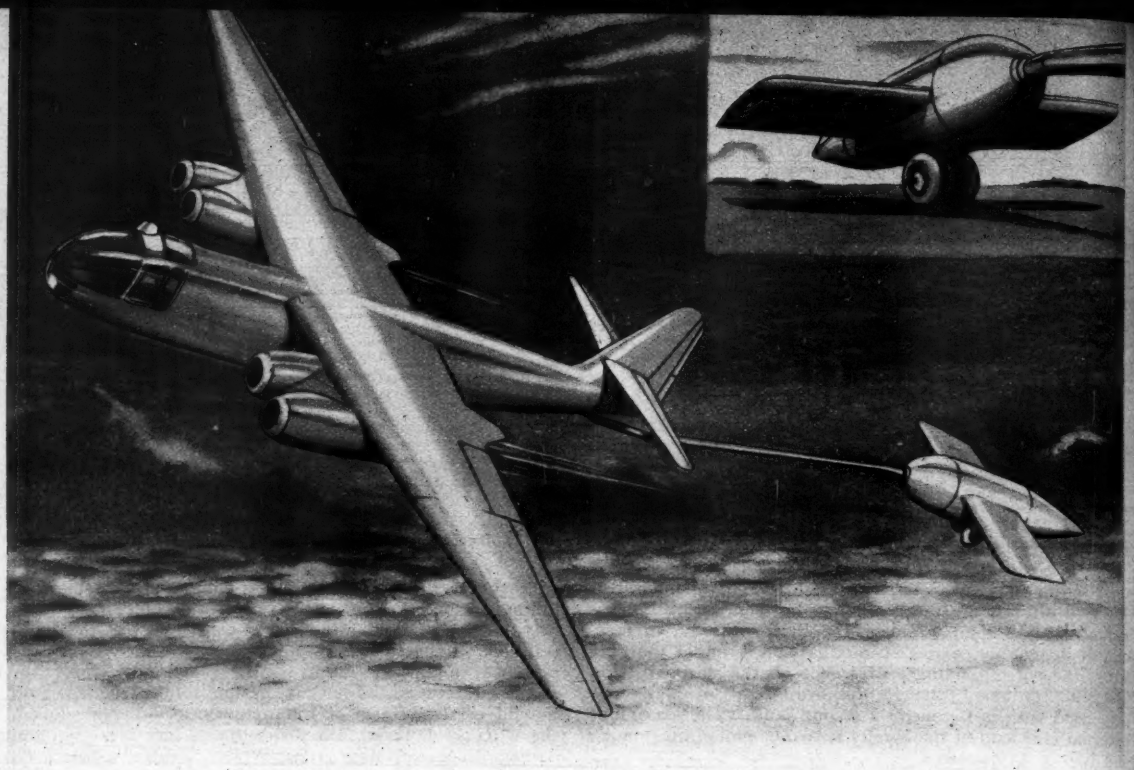
A natural question relative to the handling of jet fighters with large wing-tip tanks is "What happens if a landing has to be made with a full tank on one wing?" On the

North American Twin Mustang escort fighter with four drop tanks.



North American Furies of the U.S. Navy, with finned tip tanks.

Lockheed P2V Truculent Turtle, world's long-distance record holder.



Arado 234C with "Deichselschlepp" towed fuel tank. *(Top, right) Detail of tank.*

EXTERNAL TANKS . . .

Shooting Star it is claimed that, because of the powerful lateral control available through the hydraulic aileron booster, such a landing can be made in safety. Lockheed point out, however, that "it is not good judgment to do so, because of the difficulty of holding the aircraft straight after landing, and the possibility of dragging the tank and setting the fuel on fire." At least two landings have been made with a full tank on one wing-tip and many with both tanks full. A Shooting Star which flew 2,240 miles in 4 hours 13 minutes, about two years ago, was fitted with two 330-U.S. gallon tanks but flew well, it is said, in spite of 2,500 lb on each wing-tip. The best examples of "centred" tip tanks are afforded by the Republic F-84 Thunderjet, which carries its bombs inboard, and the North American Fury, the tanks of which are finned, to stabilize them when they are thrust away from the tips.

Swept-back wings introduce new problems. No longer can the tanks be mounted at the extremities of the wing, for these are likely to be behind the centre of gravity; thus in the new North American F-86, the designer has reverted to inboard underslung tanks.

Perhaps the most remarkable application of drop tanks, in respect of number, and quantity of fuel disposed, was to be seen in the piston-engined North American Twin Mustang, which flew non-stop from Honolulu to New York, a distance of 5,051 miles, in 14 hours, 33 minutes. The drop tanks (one of which was jettisoned in the sea west of San Francisco, though failure of the release gear made it necessary to retain three tanks for the whole flight) brought up the fuel capacity to 2,215 U.S. gallons.

German fighter designers utilized ventral and underwing drop tanks, but were striving to protect the range of their aircraft by less orthodox means. In the late days of the war, plans were in hand for converting Me 109 and Fw 190 fighters to utilize the "Doppelreiter" scheme, which entailed deepening the wing section and carrying fuel between the top surface of the normal wing and the skin forming the false section. Reduced drag, as compared with normal drop tanks, and reduction in manufacturing time and material, were foreseen.

More ambitious was the "Deichselschlepp" towed fuel-tank scheme, studied jointly by Messerchmitt and Arado, and intended for application to the Fw 190, Ta 152 and Do 335 piston-engined fighters, and the jet-propelled Me 262 and Ar 234. Some tanks tested were of all-wing design (which was preferred) and others of conventional layout, like small aircraft, with or without tail. A tank of 880 gallons capacity was being studied by Arado, but there was some doubt as to its practicability.

The "Doppelreiter" and "Deichselschlepp" methods have been studied both in Great Britain and the U.S.A., and the latter may yet be adopted in certain instances, for the difficulties of providing supplementary tankage are not yet satisfactorily resolved.

Showing the appearance of a fully tanked Supermarine Seafang.

Supermarine Attacker, as fitted with 270-gallon belly tank.

A Boeing Stratocruiser in its true element, above the clouds.

SPEEDBIRD STRATOCRUISER

A New Aircraft for B.O.A.C.'s Western Route

NORTH Atlantic operations will be watched with unusual interest as four international airlines introduce a new type of aircraft during 1949. The Boeing Stratocruiser has been ordered by two American domestic operators—United Airlines and Northwest Airlines—and by B.O.A.C., Pan American Airways, A.O.A., and S.A.S., all of whom compete across the dollar-earning North Atlantic.

Only last week Pan American Airways took delivery of the first of twenty and the remainder are expected at the rate of three a month. The British Corporation has six on order and expects delivery of the first some time during the summer. Final operating plans are still unsettled as they must remain until true operating data over the route can be gathered and analysed.

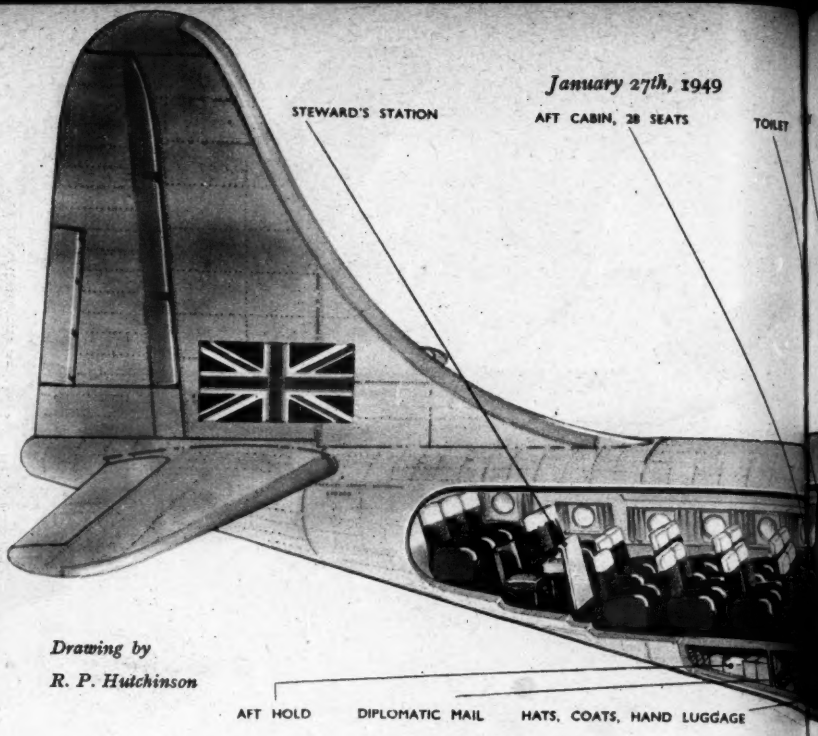
As a temporary measure during the move of the Western Division from Dorval to Montreal, B.O.A.C. is flying each way across the Atlantic three Constellation services a week between London and New York, and one between London and Montreal. Six services are maintained between New York and Bermuda. When the move is complete and normal services can be resumed, then the Corporation may be expected to fly six return flights to New York and three to Montreal, whilst maintaining the same services to Bermuda, with six Constellations. The six Stratocruisers are intended to supplement North Atlantic services, but to what extent, or even whether they will merely replace Constellations, must obviously depend upon traffic demand. It may even be economic to fly Stratocruisers between London and New York and Constellations on the Montreal route, and also, maybe, Stratocruisers will fly to Bermuda. Pan American have already announced non-stop flights between New York and London, a service which B.O.A.C. will obviously consider and provide if operating conditions permit.

Stratocruiser servicing at Filton was the original cause of the move of the Western Division from Dorval, and it is highly probable that flying training will also be conducted from Filton; if not, it will most certainly be from some other airfield in the United Kingdom and not from Canada or the U.S.A. In honour of the Short "C" Class flying-boats, which served so magnificently on the Empire routes for ten years, these new Stratocruisers will be named *Caribou, Canopus, Cabot, Castor, Cambria* and *Caledonia*.

Probably one of the best-known features of the Stratocruiser is its "double-bubble," or "figure-eight," fuselage section which provides such flexibility in load-carrying ability and interior accommodation. The unusual roominess is due largely to that design and the capacity of this two-deck transport has been compared with that of a modern five-roomed house. The Boeing Company's basic plan for a main deck seating 60 passengers by day or 52 at night, with berths for 27, has been followed quite closely by the initial six customers, but variations have been made in cabin and chair fittings, location of the galley, and details such as interior colour schemes and decorations. The Pan American Airways' arrangement, with the galley at the rear, double rows of chairs on the top deck, and the two cargo compartments and a lounge on the lower deck, is near standard. On the other hand, B.O.A.C. has selected an amidships position for the galley connected by dumb-waiter to the snack-bar on the floor below. In the rest of the fuselage there is a similarity to the interior layout of the Corporation's two-deck flying boats, the

Hythe, Plymouth and Solent classes.

According to present plans the Speedbird Stratocruiser will provide accommodation for 60 passengers by day in chairs. The proportion of berths to chairs is variable, a possible arrangement accommodating 24 sleepers and 28 passengers in chairs. The twelve seats in the lounge will not be bookable—an arrangement which at first may appear extravagant, especially since the Stratocruiser will fly the Atlantic faster than any transport aircraft hitherto employed. Half a day will be necessary for a direct flight between New York and London, and the provision of alternative seating on the lower deck will add immeasurably to passenger comfort and to the attraction of air, against sea, travel on that route. The layout has retained a maximum of flexibility in accommodation, providing all passengers with a sit-up seat, or alternatively, with any cabin reserved for sleeping. This arrangement does not necessarily mean an introduction of first- and second-class fares, although extra will be charged for sleeper accommodation. On the upper deck, aft of the flight deck, the forward cabin con-



Drawing by R. P. Hutchinson

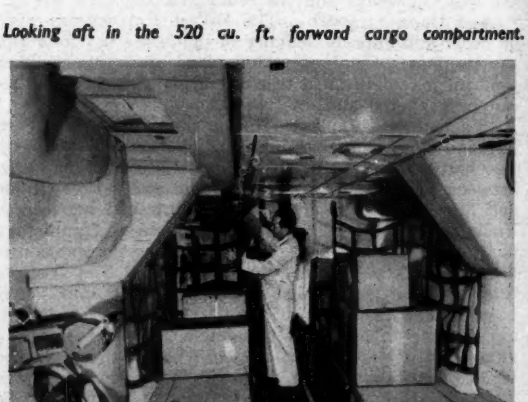
SPEEDBIRD STRATOCRUISER . . .

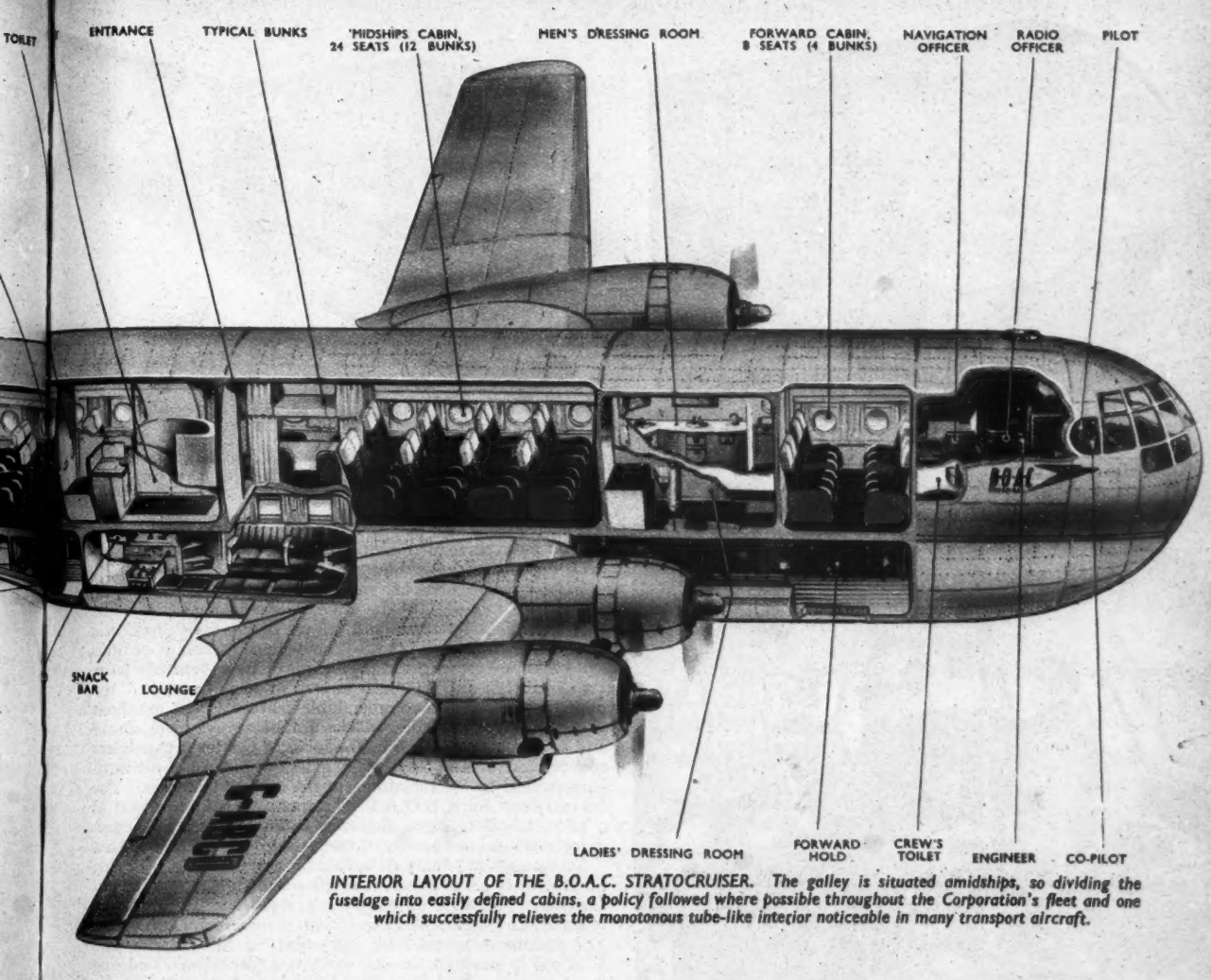
Behind the Stewardess are two high-speed electric ovens.

Upper deck on a Pan American Airways Stratocruiser.

The cocktail lounge on the upper deck seats twelve passengers.

Looking aft in the 520 cu. ft. forward cargo compartment.





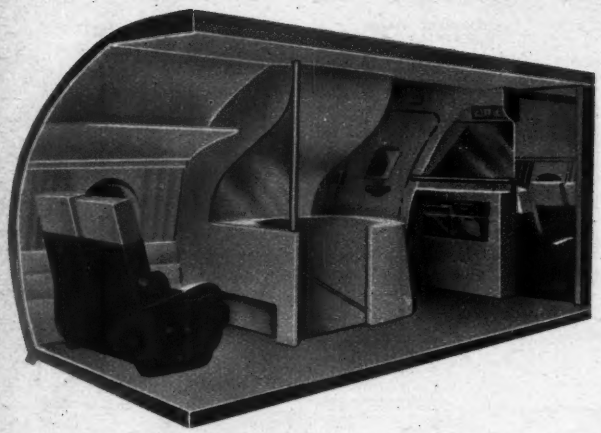
INTERIOR LAYOUT OF THE B.O.A.C. STRATOCRUISER. The galley is situated amidships, so dividing the fuselage into easily defined cabins, a policy followed where possible throughout the Corporation's fleet and one which successfully relieves the monotonous tube-like interior noticeable in many transport aircraft.

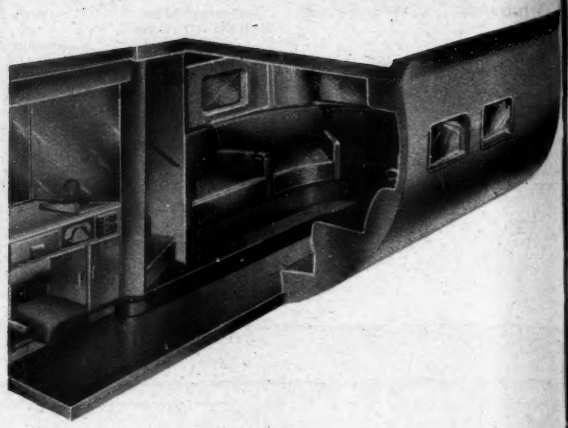
tains four convertible seats in pairs; they are situated face-to-face on each side of the aisle. By this arrangement the eight-seater saloon can be quickly converted to a four-sleeper cabin. In the main compartment, aft of the ladies' and gentlemen's dressing-rooms, there are twelve double convertible seats, six in pairs on each side of the aisle, forming three double berths on each side. Single berths let down from the roof. Farther aft, the vestibule comprises the main entrance door, the top of the staircase, the galley and a toilet. In the aft cabin there will be 28 seats, of which 12 are convertible, arranged with eight double seats on the port side and four double and one single seat on the starboard side, with a triple seat across the cabin at the rear. Thus, upper single berths will be installed in the forward compartment and the forward part of the main cabin, and lower double berths in both main and aft cabins. Allowing for 60 passengers and hand luggage, there is also space for some 2 tons of mail and cargo, but naturally the load will be varied according to weather and other circumstances. The main cargo hold is situated forward of the main spar beneath the forward cabin and dressing-rooms.

Throughout the aircraft runs the Corporation's colour theme of dark blue chairs against a lighter blue carpet, and light cream-grey wall trimmings and curtains. The ladies' dressing-room, equipped with a settee and two dressing-tables, is a combination of rose, light grey and dark blue, whereas the gentlemen's dressing-room is finished in terra cotta and cream. The lounge will be decorated in a combination of light grey and light blue. A light-weight carpet is spread on the floors of the passenger cabins, but other floors are covered with Matt Avtrim, The walls up to dado height are in Morocco Avtrim, and above, in a light all-wool cloth. Passenger chairs are covered in Bedford cloth, with leather arm-rests, but seats in the lounge are entirely in leather. Walls in the passage ways are lined with plywood flexwood, a veneer of English oak on a canvas backing, finished in a light colour. A choice of rectangular or circular windows is given by the manufacturers, and B.O.A.C. have chosen circular for both upper and lower decks. Some American users have chosen different for each deck. The convertible chairs make up into beds measuring 6ft 4in long by 42in wide, and the upper berths, which fold into the upper cabin walls when not in use, measure 6ft 3½in long by 40in wide.

Cabin comfort is maintained by a combination of direct ventilation and warm-wall radiant heating. Air at controlled temperature passes through the walls and the double-pane windows before entering the cabin at the ceiling. By this system the aircraft may be heated to 70 degrees F., when in the air or on the ground, with the temperature outside as low as 60 deg F below zero. The cabin air, which is changed every two minutes, passes through filters and deodorising equipment.

Ideal for operation on the North Atlantic route, the Stratocruiser is capable of operating at heights up to 25,000ft. Sea-level air pressure conditions can be maintained inside the aircraft up to 15,000ft above which the cabin altitude rises to 5,500ft at 25,000ft actual altitude. Access is through a large entrance on the upper deck, but cargo, mail and

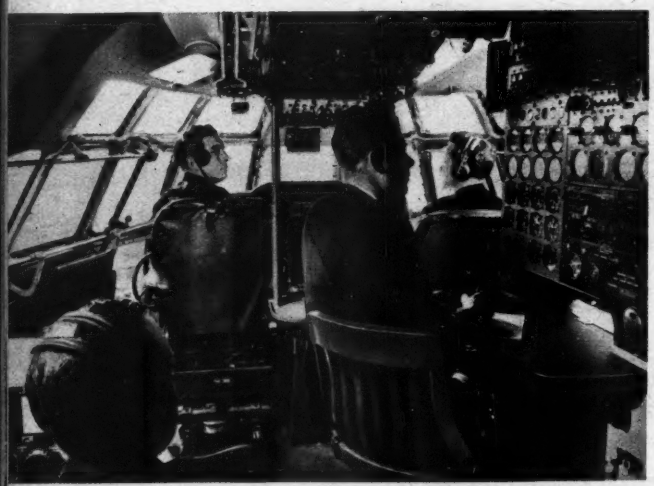




SPEEDBIRD STRATOCRUISER . . .

A true flight deck accommodates the flying crew. The navigator's position is aft of the radio operator on the port side.

Left. The main entrance on the upper deck is immediately forward of the stairway which leads to the cocktail lounge on the lower deck, seen in the drawing on the right.

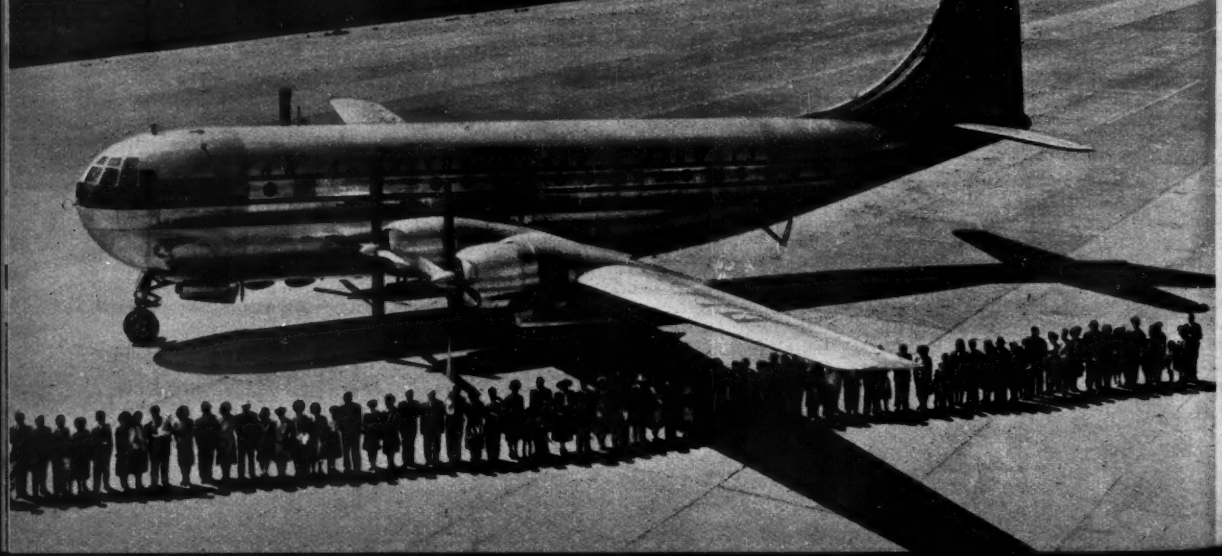


freight may be loaded simultaneously through two lower-deck doors, and galley supplies through a service door.

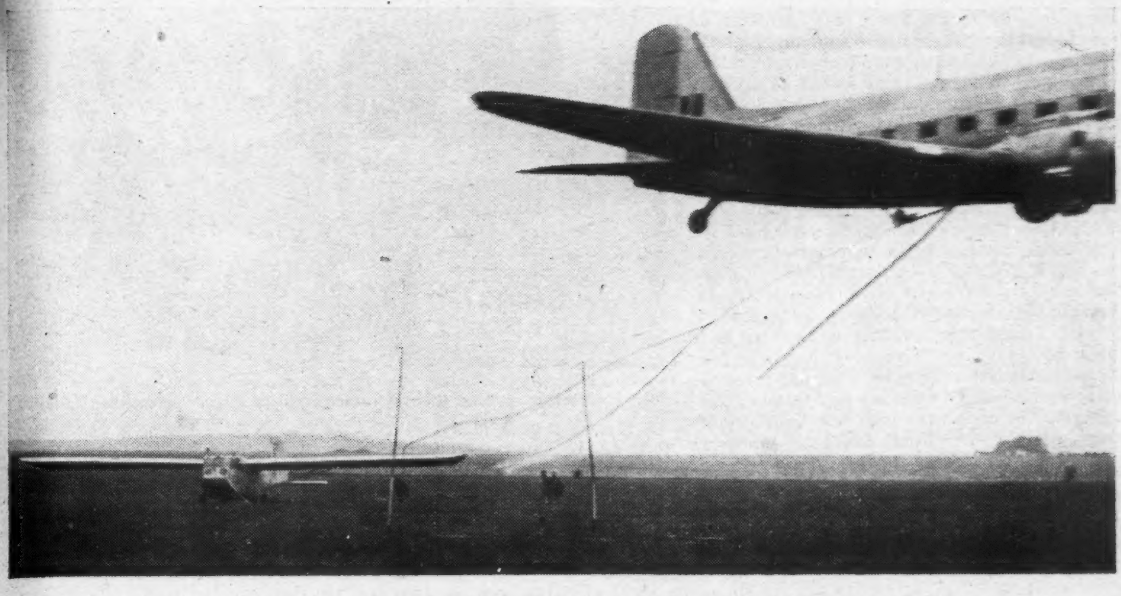
In contrast with the majority of current designs, the nose of the Stratocruiser is of the same cross-section as the widest section of the upper deck and full use of this width has been made to provide the crew with adequate accommodation. The cabin is 15ft long and 11ft wide, includes separate lavatory facilities, and has been named in some quarters "the pilots' parlour." A commendable feature is the excellent vision through 19 windows above and below eye-level, ahead and to each side. Those in the forward eye-level panels are constructed of non-icing Nesa glass, whereas hot-air anti-icing is used on the remainder of the cockpit windows. The normal crew for a B.O.A.C. Stratocruiser would consist of a pilot, co-pilot, flight engineer, radio operator and navigator, with one head steward, two stewards and a stewardess.

Static tests and analyses have substantiated for the Boeing Stratocruiser an eventual take-off weight of 147,000 lb, but the present certificated weight is 142,500 lb. At this maximum all-up weight the take-off run is just over 2,000 yards. The maximum range, with zero wind, no fuel reserve, and a 10,500 lb payload, is estimated at 4,600 miles. Cruising speed at 25,000ft is given as 300-340 m.p.h.

A full complement of 75 passengers lined up alongside Pan American Clipper America, which is expected to be the first to land in England.



AIR AMBULANCE DEMONSTRATION



Fully proved as a safe and practicable operation, the glider "snatch" nevertheless remained the most spectacular item on the Brize Norton programme. A Dakota and Hadrian are seen at the moment of contact.

Service Medical Officers Witness Methods of Casualty Evacuation

Illustrated by "Flight" photographs.

AT Brize Norton R.A.F. Station, on Thursday, January 20th, the most distinguished figures in Service medicine, accompanied by many of their principal subordinate medical officers, forgathered to study under first-hand conditions the operational aspect of aerial casualty evacuation.

Proof of the humanitarian value of this service for the wounded is afforded by the R.A.F.'s outstanding work during the war, and, although the number of lives thus saved can never be definitely assessed, some indication is given by the casualty-carrying statistics of the war years. In 1944 alone no fewer than 300,000 wounded Servicemen were transported by the R.A.F. in all theatres. Nearly all the casualties suffered in forward areas in the Far East were taken out by air, and sixty per cent of those in Western Europe between D-day and VE-day.

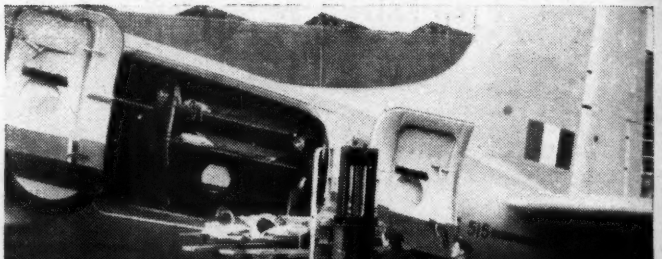
Evacuation from forward airfields presents no great problem, and to-day's capacious military transports can normally be converted for ambulance duties without difficulty in a short space of time. Conditions of modern warfare certainly demand, however, that, supplementary to the freighter/ambulance, must be some type of "feeder-line" aircraft, capable of evacuating from almost inaccessible areas those casualties to whom prolonged delay and discomfort would prove fatal. The selection of aircraft, and the evolution of suitable technique, for the latter duty will obviously be the subject of a great deal of careful consideration by both operational and medical authorities, and it is in this connection that the experience gained by the medical experts at Brize Norton will prove most valuable. Present at the demonstration were the Medical Directors-General of all three Services—Air Marshal P. C. Livingston, C.B., C.B.E., A.F.C., F.R.C.S., K.H.S., Surgeon Vice-Admiral C. E. Greeson, C.B., M.D., Ch.B., K.H.P., and Lt.-General N. Cantlie, C.B., M.C., F.R.C.S., K.H.P. They were accompanied by A. Cdre. G. E. Nicholetts, C.B.E., A.F.C., the Director of Organization at the Air Ministry, and met by A.V-M. A. C. H. Sharp, D.S.O., A.F.C., the Air Officer Commanding No. 38 Group.

The morning was devoted to an inspection of the static exhibition—a line-up of nine aircraft with their stretcher accommodation displayed. Dummy casualties were swiftly and smoothly passed through the high double doors of the Hastings with the aid of the Stacatruc, and installed in stretchers positioned four-deep inside the aircraft. Ambulance duties are

The Sikorsky Hoverfly 2, carrying one external litter, was demonstrated with a "patient."

Air Ambulance Demonstration...

among the normal roles of the Hastings and Valetta, also displayed at Brize Norton, and conversion is accomplished in less than an hour. Maximum casualty complement of the Hastings is 32 stretcher and 28 sitting cases, with four attendants, and a ton of medical supplies, while the Valetta has provision for 20 stretchers, two seated patients, and two attendants. Various methods of carrying a casualty, while retaining military value as air observation posts, were shown by the Prestwick Pioneer, Auster A.O.P.6, and a mock-up of the Auster Avis with a stretcher behind the pilot's seat, attainable through a fuselage door. Essentially civilian in external appearance, the Gemini, Aerovan and Chrislea Super Ace represented a class also adaptable for medical duties. Completing a rather mixed bag were the Bristol 171 and Sikorsky Hoverfly 2 helicopters, the latter with an external litter, as demonstrated at Old Sarum last October.

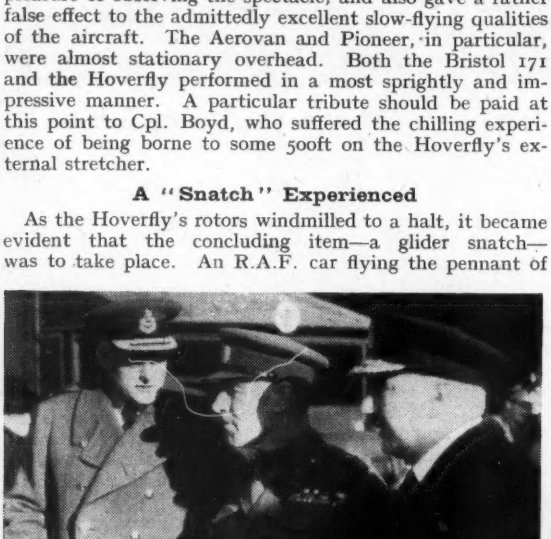


The Stacatruc enables pairs of casualties to be placed inside the Hastings fuselage with a minimum of discomfort.

During the early afternoon, the light aircraft took part in a short flying display. A bitterly cold wind estimated at about 50 m.p.h. detracted from the pleasure of observing the spectacle, and also gave a rather false effect to the admittedly excellent slow-flying qualities of the aircraft. The Aerovan and Pioneer, in particular, were almost stationary overhead. Both the Bristol 171 and the Hoverfly performed in a most sprightly and impressive manner. A particular tribute should be paid at this point to Cpl. Boyd, who suffered the chilling experience of being borne to some 500ft on the Hoverfly's external stretcher.

A "Snatch" Experienced

As the Hoverfly's rotors windmilled to a halt, it became evident that the concluding item—a glider snatch—was to take place. An R.A.F. car flying the pennant of



Air Marshal P. C. Livingston (left), Medical Director-General of the R.A.F., was accompanied by his "opposite numbers" of the Army and Navy—Lt.-Gen. Cantlie and Surgeon Vice-Admiral Greeson.

an Air Marshal was heading across the airfield for the "parked" Waco Hadrian glider, the now familiar "goal-posts" were in position, and a circling Dakota had dropped its pick-up hook. The three medical Directors-General had decided to assess personally the value of this method of removing casualties. A successful snatch having been accomplished, a small number of correspondents remained to participate in a repetition of the operation, kindly "laid on" by the Transport Command Development Unit, organizers of the demonstration.

The Hadrian had been put down by Sgt. Bell, of the Glider Pilot Regiment, on almost the original spot, and with a pleasant absence of the "flap" and bustle normally associated with flying, we entered the glider, fastened safety belts and, the 250ft nylon towline having been attached and prepared for the pick-up, waited for the Dakota to "take us away." It approached at some 125 kts and was clearly audible during its low run-up, which demands extremely careful judgment on the part of the pilot. Our tow-rope was hooked on the first attempt.

The actual contact is seen quite distinctly from the Hadrian cockpit, as the glider is naturally offset in relation to the track of the pick-up machine. There is a definite shock—between 3 and 4 g—as the Hadrian accelerates, but it comes as no surprise, and causes very little physical discomfort. Much of the inertia is absorbed by the stretch of the nylon towline, and a braking winch in the Dakota, which carries a 1,000 yd line, accounts for the remainder. The time taken to accelerate to towing speed—115 kts—is estimated as between 7 and 8 seconds. Co-ordination is the key to the successful glider snatch, and credit must be shared between the glider-pilot, tug-pilot, and winch-operator. Such an operation has undeniable value in rescue and casualty evacuation from inaccessible areas, where urgency justifies the very slight risk of injury during the actual pick-up.

HERALD

A FEW people "in the know" have been watching with interest the progress made with the prototype Herald ultra-light aircraft which is being produced by the Hants and Sussex Aviation, Ltd. It is the policy of the firm to withhold full details until the prototype has flown, but as so often happens, quite a lot of information seems to have leaked out in advance of this event.

The Herald is a single-seater originally intended to take the Continental A.40 engine. Dollar difficulties have made it necessary now to specify a 36 h.p. J.A.P. for the prototype, but provision has been made to fit a higher powered engine later. The airframe is of mixed construction, the wings being of wood, and the fuselage mainframe of very simple tubular type with fabric covering. The span is 29ft, the wing area 145 sq ft, and the all-up weight will be in the region of 800 lb. It is estimated that the maximum cruising speed will be 85 m.p.h. at sea level. Stalling speed is quoted as 38 m.p.h., and sea-level rate of climb 410 ft/min. A recent modification to the original design is the provision of a fully cantilevered main undercarriage.

During the next few months the components of the prototype Herald will be assembled in the company's recently constructed premises at Portsmouth Airport.

The Ultra Light Aircraft Committee naturally have a keen interest in this newcomer among J.A.P.-powered single-seaters. It will be remembered that they have purchased all available power units of this type. It is most unfortunate that the ultra-light movement should continue to be handicapped by shortage of power units of suitable output and modern design.

REFUELLING IN FLIGHT

Development and Economics of a System which Increases Payloads and Reduces Maintenance

NOTWITHSTANDING the considerable accumulated experience in the technical aspects of refuelling aircraft in flight, neither the Ministry of Civil Aviation nor the Corporations has come to any decision as to the adoption of the system on the long-distance air routes. The reports on the B.S.A.A. trials over the South Atlantic and those of B.O.A.C. over the North Atlantic are apparently still being analysed. In the meantime the U.S. Air Force has been making good progress with this method of extending bomber range, and there is little doubt that it will be rapidly developed in America.

The main principles of refuelling in flight have been described from time to time in this journal, but in the paper which he read before the annual meeting of the Society of Automotive Engineers in Detroit, on January 13th, Mr. C. H. Latimer-Needham, chief engineer of Flight Refuelling, Ltd., described the system in great detail, and examined the economics of refuelling in flight.

On the assumption that our readers are already familiar with the main principles of the system, we refrain from quoting those parts of the paper which describe its features and outline the history of its development. It is, however, surprising to find that although the system is in this country always linked with the name of Sir Alan Cobham, the Americans have done a great deal of work in the past, before Sir Alan founded Flight Refuelling, Ltd. No one has, however, continued development work as persistently as he.

Hitherto the flow of fuel from tanker to receiver aircraft has been by gravity. This means that the tanker has to fly at a higher level than the receiver. Pumping would have the advantage of giving a greater range of formating positions and might make possible a reduction of hose length and drag, and increased rates of flow. Mr. Latimer-Needham outlined a pump system which, for the expenditure of one kilowatt, enabled formating height to be reduced from 75 to 50ft with the same rate of flow through the same length of hose. Jet-propelled aircraft will require a much higher rate of flow than the present 100 to 120 gallons per minute, and developments are in hand aimed at rates of 250 to 300 gallons per minute.

A large part of Mr. Latimer-Needham's paper was devoted to the economics of flight refuelling. There is, he said, a basic still-air range of approximately 3,000 miles, which is sufficient to enable all airliners to operate on flight-refuelled services over most of the world's air routes, irrespective of total route length. Three vital corollaries followed from this fact:—

(i) For any given payload, the requirements of all long-distance routes can be met by a single aircraft specification, leading to standardization of design and of air fleet.

(ii) The relatively short-range requirement exercises a profound influence on the size of airliner, enabling it to be considerably smaller than one designed to cover the route non-stop without flight refuelling.

(iii) By restricting the fuel load to a practical proportion of the aircraft gross weight, a high payload factor is ensured.

Mr. Latimer-Needham then examined the world's air routes, and outlined possible arrangements of refuelling points on some of them. London-New York is one of the most important, and it was found that an airliner should ideally have a fuel capacity of rather less than half the disposable load. The accommodation for passengers and freight should be such that its own weight plus the payload accounted for the remainder of the disposable load. This was, he said, a fundamental consideration. It might be affected by frequency of service, but the fifty-fifty fuel/payload rule gave maximum efficiency.

This study, Mr. Latimer-Needham said, led to the conclusion that aircraft should be designed in ranges of progressively stepped-up sizes so as to cater for, say, 50, 100, 150 passengers, etc. The fuel load, being roughly equal to the useful load, would be found to give an unassisted range of approximately 3,000 still-air miles, and this could be extended to any desired distance by means of flight refuelling.

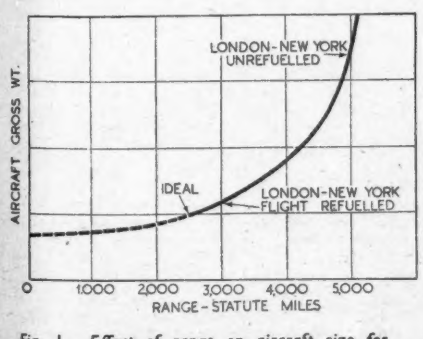


Fig. 1. Effect of range on aircraft size for constant payload.

Range and Size

The effect of range on aircraft size was dealt with next. It is shown graphically in Fig. 1, in which payload is assumed constant. It is seen that the rate of increase in size beyond the "ideal" becomes increasingly steeper. Thus the aircraft of 5,000 miles' range designed for the London-New York route, unrefuelled, is three times as large as the ideal airliner. It was, he said, now easy to see how the quest for long range was likely to lead to large-size uneconomical aircraft.

Fig. 2 is based on a number of designs prepared for the flight-refuelled North Atlantic route. It is seen that payload, expressed as a percentage of the gross weight, increases as the weight increases, and reaches a figure of 15 per cent of W at a gross weight of about 125,000 lb. At 250,000 lb the payload amounts to as much as 17 per cent W. The payload also increases with gross weight for flight-refuelled airliners, in contradistinction to the diminishing payload of unrefuelled aircraft designed for long-distance routes.

Mr. Latimer-Needham calculated that for the North Atlantic route a flight-refuelled aircraft need be only between one-half and one-third the size of one designed to take off with sufficient fuel for a 5,000-mile flight. This was important because the initial cost of an aircraft, the cost of insurance, fuel and oil, and maintenance, were all roughly directly proportional to the size of aircraft. Also

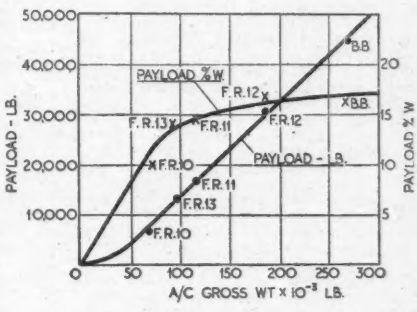


Fig. 2. Payload of flight-refuelled passenger airliners on the London-New York route.

the problems associated with the design and construction of giant aircraft were avoided.

Another benefit arising out of flight refuelling was the reduction in airport size and runway lengths, as the machine takes off relatively light. Mr. Masefield had shown in his lecture how cost of aircraft per pound of equipped weight rose with increase in size. This was avoided with flight refuelling. Headwinds were another bugbear of long-distance non-refuelled flights. With flight refuelling, it would often be possible to achieve full capacity payload on both westward and eastward flights.

Intermediate landings for taking on fuel caused delays. With the greater speeds expected, this became more serious. At an average ground speed of 450 m.p.h., a two-hour delay (one hour for each intermediate stop) in a journey time of 10 hours would reduce the effective speed to 375.5 m.p.h., a loss of nearly 100 m.p.h. Every take-off and landing also represented an extra element of risk, and the greater part of engine wear and tear took place during take-off. During the B.S.A.A. and B.O.A.C. experiments, it was found that the receiver aircraft required a remarkably small amount of maintenance.

In order to get the maximum possible benefit from flight refuelling, it was necessary to design the aircraft specially for the job. A flight-refuelled transatlantic airliner to carry a passenger payload of 50 would weigh about 100,000 lb. If 100 passengers were to be carried, the gross weight would be about 160,000 lb. Payload percentages for the two cases would be about 13 per cent W and 16 per cent W respectively. Mr. Latimer-Needham argued that three generic types of airliner would meet the requirements of air transportation on practically all the world's air routes. They would have payload capacities of 50, 75 and 100 passengers respectively. Their main particulars would be:—

No. of passengers	50	75	100
Gross wt. (lb) ..	100,000	130,000	160,000
Payload (lb)	13,000	19,500	26,000
Payload % W	13	15	16
Wing area—			
(65 lb/sq ft) ..	1,540	2,000	2,465
Wing span (ft)			
(A.R.10)	124	142	157

For North Atlantic traffic it was estimated that five airliners, each carrying 50 passengers and making two daily trips, or ten daily departures in all, would meet requirements. A flight-refuelled airliner for 50 passengers would be relatively small, and would present no new difficulties or experimental features. Such an airliner had been made the subject of a design study, and Mr. Latimer-

Refuelling in Flight . . . . .

Needham gave particulars of four versions, in order to allow for future developments. They were:—

F.R.13 (with piston engines driving airscrews); F.R.14 (with gas turbines driving airscrews); F.R.15 (with plain jet propulsion); and F.R.16 (with compound engines driving airscrews). The four designs are shown in Figs. 3, 4, 5 and 6.

As the normal payload was the same for all four designs, the fuselage accommodation was basically the same. By arranging wing loadings, operating heights, and desired cruising speeds to give optimum conditions, it was found possible to utilize the same basic wing for all four designs. The main differences were to be found in the power-plant installations, and in their fuel systems. The jet-propelled project had a shortened undercarriage and a modified fin and rudder. The salient features of the four machines are given in the table.

Operational data for the four types are shown diagrammatically in Figs. 7 and 8. Normal full payload of 13,300 lb can be carried in all four types for all wind conditions. Under average conditions the interception points on westbound flights would be over Shannon and Gander, while for strong headwinds the first interception would be a short distance west of Shannon. Mr. Latimer-Needham dealt in great detail with calculations and estimates for the operations, but unfortunately we have not the space to give these considerations in detail.

Overland Routes

Mr. Latimer-Needham then turned to an examination of an overland service with a flight-refuelled Handley Page Hermes. He pointed out that it is generally permissible to bring the flying weight of an aircraft (after refuelling) to a figure greater than its normal maximum take-off weight. The effect of this is a further increase in payload, and at the same time the distance to the optimum point is reduced, thus diminishing the tanker flight length.

Referring to Fig. 9, which relates to the Hermes operating over a route of 2,000 miles, it is seen that for the normal gross weight of 80,000 lb the optimum point (O.P.) is 665 miles from the origin, and the payload is 11,000 lb, an increase of 5,700 lb over that carried in unrefuelled flight. By increasing the flying weight by 2½ per cent of the gross weight, the payload increases to 12,300 lb, and the optimum point distance is reduced to 585 miles. Similarly, for a 5 per cent overload the corresponding payload and refuelling point distance become 13,650 lb (maximum payload capacity) and 500 miles respectively.

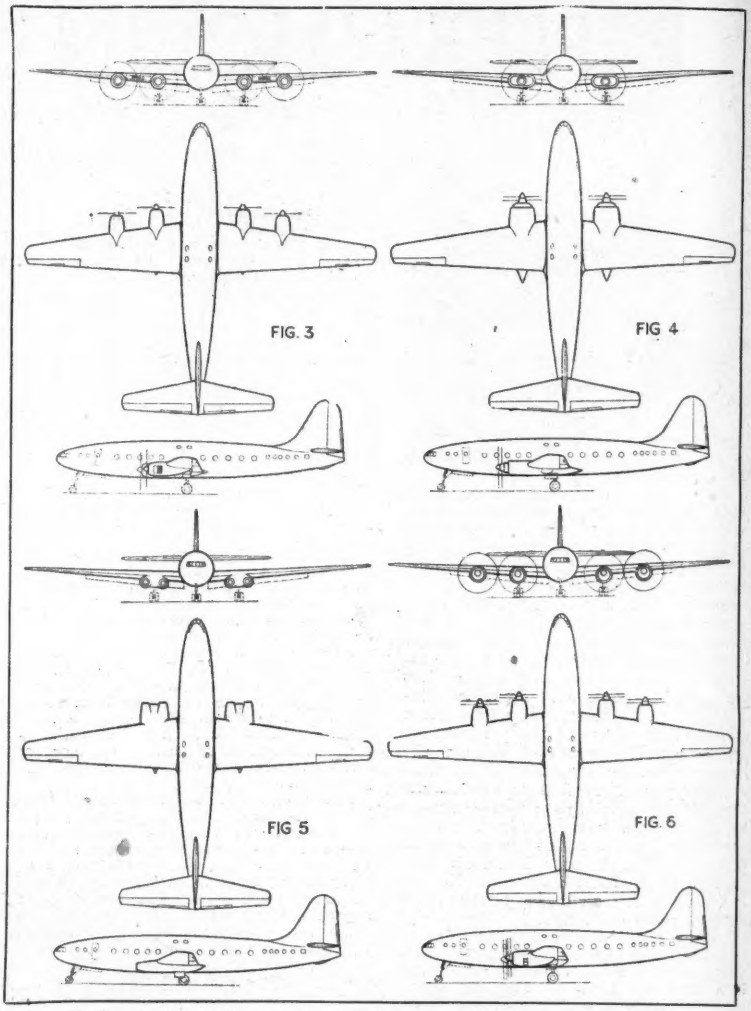
A series of formulæ was given by means of which a fairly accurate route analysis could be made. These should enable potential operators to estimate the merits of flight refuelling on their routes.

Having outlined the benefits to be derived from flight refuelling, the next step was to examine the other side of the ledger and find out the cost of the operation. Mr. Latimer - Needham pointed out that it was possible to assess the value of some of the advantages in terms of cash, but not all. Among the latter were the value of non-stop services, and the regularity and punctuality of services.

To give some idea of the actual cost of fuel transfer en route, the case was taken as an illustration of a future frequency of at least two per day, in which case the cost of a refuelling with a tanker of about 65,000 lb weight should not exceed £250. This figure allowed for a tanker flight duration of 2½ hours, or a radius of operation of about 100 miles. Increments of radius increased the cost by about £30 per 100 miles. In the case of only one operation a day, if it were considered necessary to maintain two aircraft at the tanker station, the cost would go up to £400, or even £450 in certain localities.

Basing his estimates on certain figures given in Mr. Masefield's paper, Mr. Latimer - Needham arrived at the conclusion that a flight refuelling cost of £250 was equal to the sum saved by the avoidance of a landing for an aircraft weighing 135,000 lb. *All other benefits of flight refuelling were gratis.*

In his very thorough survey of flight refuelling, Mr. Latimer-Needham did not confine himself to civil aviation. The possibilities for bombing are obvious, and he took as an illustration a hypothetical bomber with a maximum take-off weight of 135,000 lb and a maximum flying weight of 140,000 lb, the latter realized after refuelling. Calculations shown in graph form indicated



Four versions of a design study of a flight-refuelled airliner to carry 50 passengers. They are: Fig. 3, the F.R.13 ; Fig. 4, the F.R.14 ; Fig, 5, the F.R.15 ; and Fig. 6, the F.R.16.

MAIN PARTICULARS OF THE F.R.13, 14, 15 AND 16.

	F.R.13	F.R.14	F.R.15	F.R.16
Max. all up weight.	95,190lb	101,450lb	109,500lb	94,000lb
Weight empty...	56,260lb	55,600lb	48,430lb	58,110lb
Equipped wt. + crew.	58,090lb	57,430lb	50,260lb	59,980lb
Max. fuel wt ...	22,000lb	30,000lb	45,895lb	19,280lb
Normal payload	13,300lb	13,300lb	13,300lb	13,300lb
Wing span ...	126ft 4in	126ft 4in	126ft 4in	126ft 4in
Length	105ft	105ft	105ft	105ft
Height to top of fin.	34ft 6in	34ft 6in	32ft 2in	34ft
Wing area ...	1,566 sq ft	1,566 sq ft	1,566 sq ft	1,566 sq ft
Max. wing loading.	60.7lb/sq ft	64.7lb/sq ft	70lb/sq ft	60,000lb/sq ft
Engines	4 Bristol Centaurus 663.	4 gas turbines	4 jet engines	4 compo und engines.
T.O. power total	11,240 h.p.	13,520 e.b.h.p.	26,000lb thrust	12,480 e.b.h.p.
Max. speed at height.	360 m.p.h. at 20,000ft(W.M.)	430 m.p.h. at 25,000 ft (5 min) 390 m.p h. at 25,000ft (Max cont).	560 m.p.h. at 30,000ft (approx).	418 m.p.h. at 25,000ft.
Cons't speed cruising.	315 m.p.h. at 20,000ft.	365 m.p.h. at 25,000 ft.	460 m.p.h. at 30,000ft.	316 m.p.h. at 25,000ft.
Range at cons't speed (no allowances).	3,180 st.m.	3,340 st.m.	2,900 st.m.	3,450 st.m.

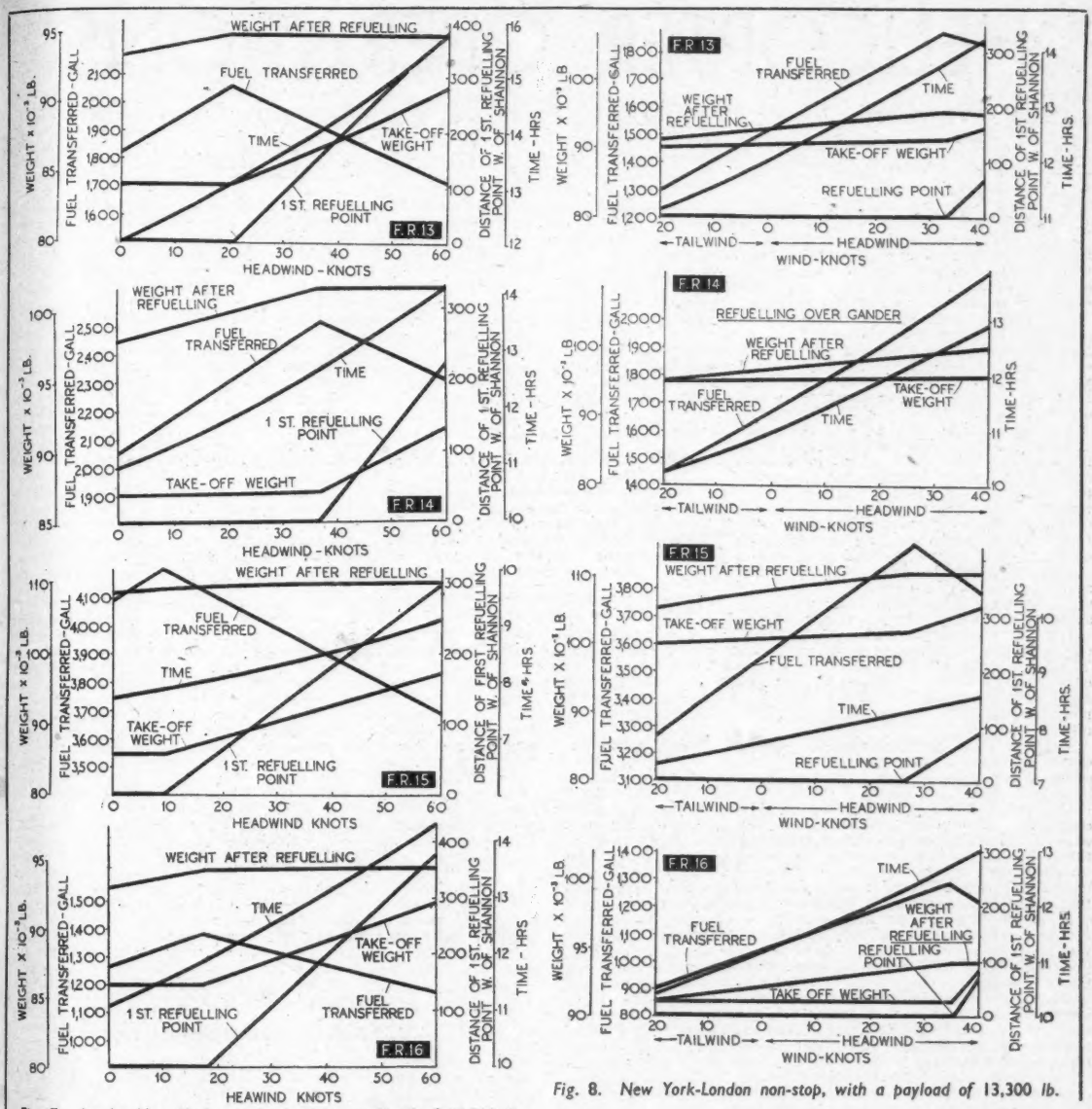


Fig. 7. London-New York non-stop, with a payload of 13,300 lb

Fig. 8. New York-London non-stop, with a payload of 13,300 lb.

that for a radius of 4,000 miles the unrefuelled bomber could carry no bombs at all, whereas if it were refuelled half-way to the target, the bomb load would be 16,000 lb. At 3,000 miles, the aircraft miles flown per pound of bomb load were 0.6 and 0.35.

Probably one of the most outstanding merits of flight-refuelling bombers was the reduction in the number of aircraft required, and hence a corresponding reduction in aircrew, ground crew and accessories, to bomb a given objective. Assuming that it is required to drop a load of about 2,000 short tons on a target 3,000 miles away. For a mission using unrefuelled bombers, 400 aircraft would be involved, all of which would have to fly over the target area, each carrying 10,000 lb of bombs. By using refuelling in flight, the number would be reduced to 308, only half of which would be involved in flying over the target area. The other half (the tankers) would only be required to fly halfway to the target. The reduction in losses would be most noticeable, and the attack could be made in much greater concentration.

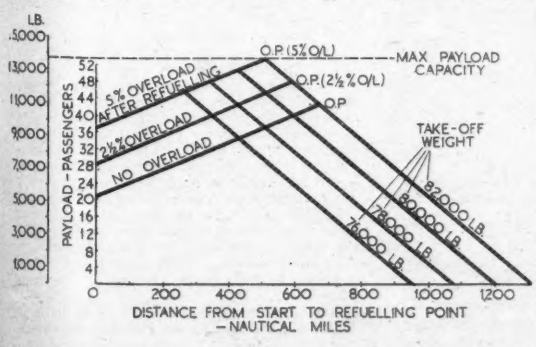


Fig. 9. Payload diagram for refuelled Hermes. Route length 2,000 miles: allowance, two hours' still-air cruising.

Flight refuelling could also be applied with advantage to reconnaissance, especially such as are carried out by Coastal Command when patrolling areas in the vicinity of convoys, when it would be possible to secure a large increase in the duration of time patrolling the convoy area. For refuelling fighters, the advantages are less easy to assess, but even here, Mr. Latimer-Needham thought, there were several applications, such as for increasing operational range, for ferrying, and for bomber support.

Military air transport, Mr. Latimer-Needham said, falls into two categories: paratroop and supply carrying. Both could benefit from flight refuelling. In the former, adequate supplies could always be flown in after the landing of the airborne troops. The second case was very similar, so far as regular supply services were concerned, to civil air transport.

HELICOPTER OPERATIONS

Some Problems and Prospects : Useful Data from Operations by the B.E.A. Experimental Unit : Means of Reducing Costs

IN the Library of the Royal Aeronautical Society on Saturday, January 22nd, Mr. N. E. Rowe delivered a very interesting paper to the Helicopter Association. Since, in his view, the important helicopter developments in this country would be connected with transport, Mr. Rowe confined his attention to the operation of the helicopter for the convenience of passengers and goods on scheduled services. He opened his paper, in which the views expressed were entirely his own, with a statement and discussion on operating requirements.

In recognizing those characteristics of the helicopter which offered such potential advantages—its ability to fly slowly and to hover, to use small and restricted areas for take-off and alighting and to move direct from point to point in three dimensions, we had also to recognize that it was a comparatively short-range vehicle up to, say, 250 miles. It was, he said, on such ranges that it offered its most effective competition to existing means of transport in this country, whereas for longer ranges the advantage tended towards the fixed-wing aircraft. Short-range operation demanded regularity and punctuality, as serious late-running or cancellation of flight on a short route had more serious immediate effect than delays on a longer route, and unless the means of transport for such journeys was reliable it would not be accepted as a convenient means of communication. Short-stage journeys invited also close comparison with surface transport in safety, regularity, economy and convenience. Thus, to become effective, helicopter operations in a country like ours must be no more affected by meteorological conditions than other surface transport. That was, he said, a fundamental requirement. In addition, operations should be as readily performed by night as by day.

MR. N. E. Rowe, C.B.E., D.I.C., B.Sc., A.C.G.I., F.R.Ae.S., Whit.Ex., is Controller of Research and Long Term Development in the British European Airways Corporation. During the war he was Director-General of Technical Development in the Ministry of Aircraft Production.

The third most important requisite was a relatively large number of rotorstations, a term used by the lecturer for landing areas, equipped to a standard necessary for regular and punctual operations in all conditions. Although the helicopter would be used where it would show to best advantage, possibly over water or difficult country, journeys would still be "local" and the safety standard would be judged by surface transport rather by than air. Moreover, the ability of the helicopter to hover and move vertically without forward speed automatically raised the safety standard to a high level and it was one of the major problems of operation to maintain that. The firm essentials, in Mr. Rowe's opinion, were good blind- and night-flying characteristics, especially in regard to stability and control in smooth or rough air, cockpit visibility and layout. It was also important, he said, to have a means of navigation from point to point in IFR conditions with a high standard of reliability. Other necessities were satisfactory recognition and let-down aids at alighting points in IFR conditions, good flying characteristics in rough air, adequate performance in regard to the character of the terrain, including the case of engine failure, the requisite standard of airworthiness, adequate means of air traffic control, the requisite operational standards and effective maintenance of all equipment. Mr. Rowe thought that the standard of regularity and punctuality should be not less than that of existing surface transport travelling over comparable distances, and, in general, a standard better than, say, plus or minus six minutes on a one-hour journey might be maintained on about 99 per cent of occasions.

In order to make fares comparable with alternative means of transport, taking into account the greater convenience of saving time, economic measures should include low capital charge of the machines, first-class reliability, economical maintenance and a high annual transport capacity for a given first cost. This depended on the product of utilization, block-speed and payload. Since short-stage operations required a large number of rotorstations, they should be necessarily simple, cheap and easily maintained and serviced. Large cities would have several to cater for traffic in various directions, a system which might be far cheaper than a complex system of air traffic control The whole matter, he said, needed careful study, keeping in mind the essential needs of regular operation in all except the most severe meteorological conditions, and basic economy. In choosing routes to give maximum advantages the preliminary aim should be to save one hour on a 100-mile journey compared with the best surface transport, taking full account of surface times to rotorstation or railway station. As well as siting rotorstations near to city centres, the study of helicopter movements into and away from busy airports should be made, as although no scheduled helicopter services from city centre to airport were envisaged, taxi services from city centre to airport would be developed.

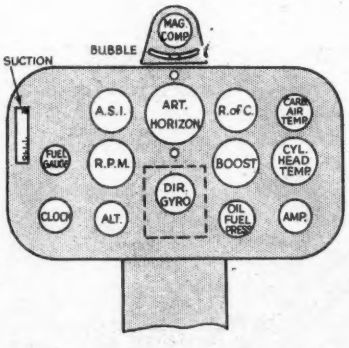
Speaking of the relationship between frequency and journey time, Mr. Rowe said that as a general rule the shorter the time the higher should be the frequency of the schedule, and frequency had a strong bearing in deciding the size of aircraft needed and in attaining the maximum annual utilization for economical running. In considering services in the Scottish Islands and Highlands, and in heavily built-up areas, the minimum requirement for regular scheduled helicopter transport operations was a twin-engined machine. The standard of comfort, he said, should be what was acceptable for a short journey, bearing in mind that it would have been by the alternative a much longer and more tedious and perhaps difficult journey. It was also necessary that the weight of furnishings and amenities should be kept to a minimum.

Commenting upon safety and regularity, Mr. Rowe quoted Dr. Edward Warner's observation in his Wilbur Wright Lecture in 1943 that regularity and safety obviously had an inverse relationship. Although Dr. Warner was discussing the problems of fixed-wing aircraft, Mr. Rowe thought that it was equally true of transport by helicopter. A helicopter pilot would continue to fly in complete safety at much lower meteorological visibility than was possible with fixed-wing aircraft because he did not rely on speed for sustentation and generally flew at a much lower height. He then gave an interesting example of the B.E.A. dummy mail operation in Dorset in February and March, 1948, when the total irregularity due to weather amounted to 3 per cent. Of that, 2 per cent was due to low clouds on high ground over which the route passed and 1 per cent was due to sea fog. On many occasions visibility was down to a quarter of a mile locally without hampering operations which were limited to contact flying only. Conditions in the worst months of the year in these islands were so poor, however, that 100 per cent regularity could be obtained with safety only by solving completely the problems of blind-flying and navigation, blind-approach and landing by day and night. It was encouraging to hear from Mr. Rowe that the results of the work already done by the B.E.A. Experimental Unit showed there was good prospect of realizing these objectives in a reasonable time. The Unit had, by November 30th last year, completed 87 hours of night- and blind-flying, of which 4-5 hours had been cloud flying by day. The longest continuous time in cloud was 20 minutes, but that could be increased with practice, although the strain of flying-blind the S.51 was higher than a comparable fixed-wing aircraft. All instruments were standard except the Artificial Horizon, which had adjustable pitch-and-roll datum lines.

B.E.A.C. Night Operations

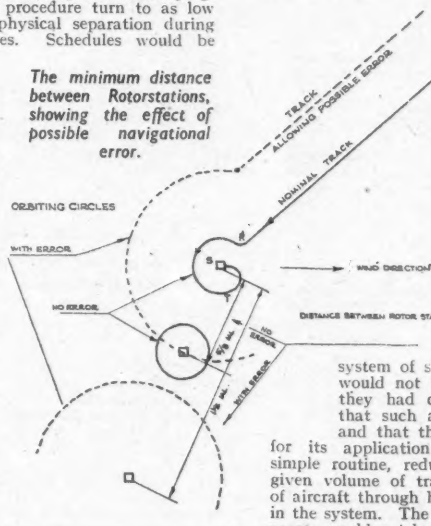
An experimental scheduled night operation was completed in the five weeks ending on September 23rd, 1948, consisting of the return flight Peterborough-Downham Market, a distance of 58 miles, which was made on four successive nights each week and on which 100 per cent regularity was obtained. The recognition aid was an occulting beacon made up of five standard sodium runway lights arranged to give a 2-second cycle. Wind direction and illumination for landing was given by a "Wiggimac" which illuminated at low intensity an area about 100ft in diameter of which the circumference was marked by a band of white on the ground. Wind direction was shown by a shadow bar and approach light. This equipment was satisfactory and the pilots were able to land without dazzle. For point-to-point navigation an adaptation of the standard SBA/VHF equipment was used, but that was not satisfactory and it is hoped that the Decca Track Guide, when available, will become the standard means of navigation. With regard to punctuality and wind allowance, the lecturer explained that the higher the scheduled mean block-speed the less margin there was of cruising speed available to cope with strong winds. It was therefore necessary to have seasonal schedules so that a tolerance of plus 10 per cent of scheduled elapsed time was exceeded on only 1 per cent of occasions in any scheduled period. This would correspond roughly to punctuality on 95 per cent of occasions.

After enumerating the differences between traffic control at airports and at rotorstations.



A suggested instrument panel layout for night- and blind-flying helicopter operations.

Mr. Rowe said that the essential features for helicopter air traffic control were the means of point-to-point navigation with high accuracy in terms of time, means of rotorstation recognition, and safe let-down in conditions of low visibility. He then gave the advantages of the Decca Track Guide system which, he thought, gave the basic means of accurate navigation. It was envisaged that a number of rotorstations would be used instead of a single main station. Each would handle the traffic from a sector, the angle of the sector depending on the density of the traffic in that general direction. Thus the main distances of the stations from the city centre would depend on the minimum safe distance between any pair. Mr. Rowe then gave a brief outline of possible let-down and take-off procedures, which required very accurate flying. The aim was to keep the radius of procedure turn to as low a value as possible while ensuring physical separation during the take-off and landing manœuvres. Schedules would be arranged so that normally such manœuvres would not take place at the same time at a given rotorstation. Traffic control *en route* relied upon high separation by quadrantal rules or otherwise, combined with scheduled flying all along the route by reference to Decca Track watch and mileage indicator.



The minimum distance between Rotorstations, showing the effect of possible navigational error.

Economy was undoubtedly the major problem to be solved before the helicopter could play its full part in the pattern of transport, and further that the machine itself, and its operation, the plan as a whole should be considered. Mr. Rowe felt that initially the cost of operation, the capital and running costs of rotorstations, and of all navigational aids including Air Traffic Control should be kept as low as possible.

In analysing present operating costs he referred to two operations of the B.E.A. Experimental Helicopter Unit, one of about five weeks' duration carrying dummy mail, and the other of four months carrying live mail. Total flying time was 1,332 hours, of which 1,019 was on the three S.51s and 313 was on two Bell 47Bs. The rate of utilization was low but the average total operating costs of the S.51 was about £28 per flying hour made up in the proportions of standing charges 33 per cent, maintenance and repairs 22 per cent, flying operations 23 per cent, station costs and headquarters charges 22 per cent. Standing charges could be reduced by increasing the utilization to 1,200 hours and making necessary adjustments in other factors. Based on an average capacity payload of 750 lb and route speed of 65 m.p.h., the operating cost per capacity ton-mile was £1 5s. Such charges would make regular scheduled passenger services uneconomical in this country, and the main factors involved in making an overall reduction of about one-quarter were, increased cruising speed to diminish the effect of adverse winds, larger size, lower first cost, maintenance organized to increase utilization and a machine with good basic qualities. In amplification he thought that we should aim during the next few years to achieve a cruising speed of 115 to 120 m.p.h. at 60 per cent take-off power and weak mixture. That would make practical a schedule of 100 miles in the hour as an average, which would give savings of time worth while paying for. The prospects of obtaining these were bright since the Fairey Gyrodyne had flown at 124 m.p.h. using less than full power. The size of an aircraft affects operating economy in that the consideration of potential traffic may demand a vehicle smaller than would be most economical judged on technical grounds alone. There was, he said, a minimum size and a tentative conclusion was for a 12- to 15-seater, but the actual figure would depend entirely upon the detailed economics of any specific design.

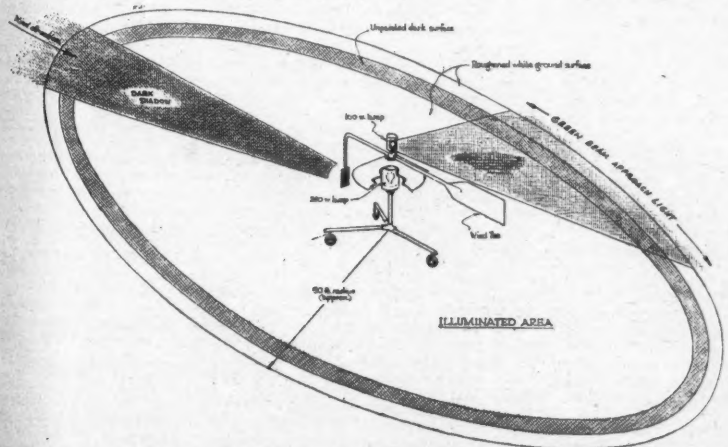
Little information was available of the probable first cost of commercial helicopters, but taking a rough figure of 1,000 lb all-up weight per passenger, first cost was of the order of £3,000 per passenger. Taking a total life of 12,000 hours the cost per hour was about £0.35, representing 15 per cent of a fare of 8d per mile. That was a very high proportion of the total cost and its reduction was of great importance to the success of helicopter commercial operation. The operator he said, would be responsible for choosing the right size of vehicle and the luxurious standards associated with fixed-wing transports would have to give way to a more austere type of seating appropriate to short stages.

Mr. Rowe was convinced that a revolution was needed in present-day methods of maintenance if high utilization and cheap maintenance were to be achieved. He described the inspection method as uneconomical and highly unscientific and a process which rested essentially on lack of knowledge. He proposed that it should be replaced by a system of sealed servicing in which parts and components would not be touched save for normal maintenance until they had completed a predetermined life. He thought that such a method would reduce costs of air operation and that the helicopter offered a particularly fruitful field for its application. Maintenance, he said, would become a simple routine, reducing labour to a minimum, one in which a given volume of traffic could be handled with the least number of aircraft through high utilization, and the high reliability implicit in the system. The cost of spares would be reduced because useless spares would not be purchased and the correct proportion of spares actually needed would be known.

Economic Maintenance Necessary

Referring again to the effect of utilization on economy, Mr. Rowe stated that whereas fixed wing transport with block speeds of 160-170 m.p.h. were utilized for 1,500-2,000 hours per annum, a helicopter would be required to do 2,500-3,500 hours to achieve the same aircraft miles per year. It was therefore imperative that maintenance should be simple and mechanical reliability very high. Helicopter operation would depend upon an adequate network of ground sites covering the country. Thus the great towns would be directly linked by a shuttle service whereas lesser towns would be linked by a circuitous stopping service. Such widespread use would take some time to develop but Mr. Rowe emphasized the relation between high utilization and frequency and the corollary that an adequate number of operating sites was needed in any area in which services were to be developed. The cost of rotorstations would depend fundamentally on the size but would be effected by position, whether it was elevated and the complexity of operating essentials such as lighting and other aids, maintenance and servicing. Elevated sites without nearby obstructions could be much smaller than ground sites and may be much easier to provide near the city centres. The whole design of such sites was intimately interconnected with the foreseen pattern of helicopter service and the problem of Air Traffic Control. Allowing for aircraft circumscribed by a circle of 100ft diameter and errors of wind and pilotage, the area should probably be of the order of 120ft × 120ft as a minimum, with additional space for parking.

An attempt had been made to assess cost with generous assumptions for the number of staff required, ground rent and the cost of ground aids. The resulting charge per landing was £10, assuming a low utilization of ten landings per day and with all costs supported by the operation. At a more reasonable utilization of four per hour the charge would be £2 10s per landing. Summing up, Mr. Rowe said that there was a good prospect of commencing operations about four years hence. He thought that the greatest doubt was the development of suitable power plants, but since our future strength in this country was likely to be in the development of the internal combustion turbine engine he suggested that we must quickly begin to apply those to helicopter development. The provision of rotorstations was necessary in advance of the operations, and Mr. Rowe was convinced that in order to have rotorstations



For night landing, wind direction and illumination was given by the Wiggimac in which the circumference of the illuminated area was marked by a band of white on the ground.

Helicopter Operations . . . . .

in the most favourable sites action must be taken now on broad and liberal lines. That would depend to a degree on the investigation into the accuracy of the Decca Track Guide System of navigation to be initiated early this year. Preliminary action could be started now, however. The potential use for the helicopter in these islands was a direct point-to-point link between all major towns and cities.

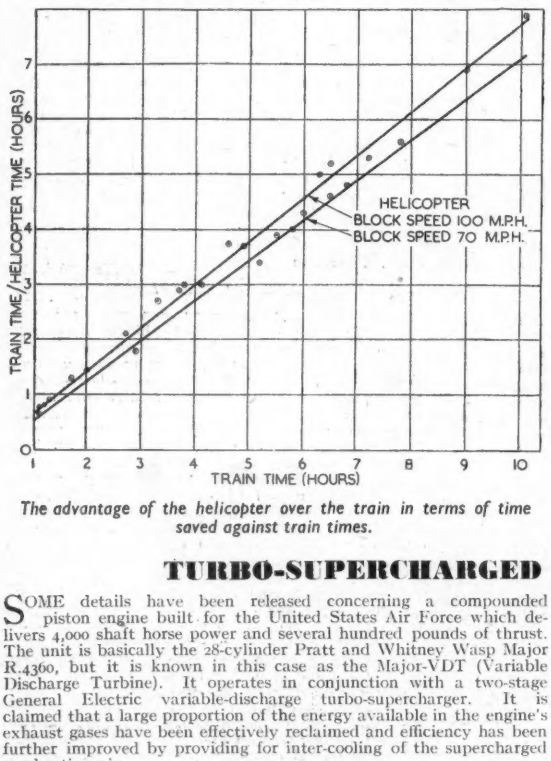
THE DISCUSSION

The lecture was very well attended, but it was obvious that most members of the audience were helicopter people rather than potential operatprs of helicopters. Mr. H. A. Marsh was in the chair, and S/L. Basil Arkell had volunteered for the task of operating the lantern.

Mr. Rowe had to present a summary of his paper, which is a very long one, but he succeeded in covering all the main points in the time available.

A very good discussion followed the reading of the paper, as several points turned out to be controversial. For example, Mr. Rowe's suggestion that helicopter maintenance time could be greatly reduced if a system of sealed service were introduced so that components need not be touched, except for ordinary servicing, until they had completed a pre-determined life, when they would be replaced by new or overhauled components.

Mr. O. L. L. Fitzwilliams thought such a procedure would tend to cause stagnation in design, but Mr. Rowe disagreed. He thought that, on the contrary, it would encourage design by finding the snags before the machine went into service.



The advantage of the helicopter over the train in terms of time saved against train times.

On the subject of navigational and let-down aids, the suggestion was made that it was high time we began thinking about the sort of aids that will be wanted when helicopters go into service. Mr. Peter Masefield expressed the hope that helicopters would be able to do without any other navigational aids than the Decca, and that at the "rotorstations" (a term coined by Mr. Rowe, which was generally welcomed) it might be possible to use lights, thus avoiding further additions to the already cluttered aids for fixed-wing aircraft. If, he said, we once made up our minds that we might be wanting these aids, then certainly we should saddle ourselves with them, and that ought to be avoided.

Some of the speakers argued that Mr. Rowe had been too modest in certain of his stated requirements. For instance, the size of rotorstation asked for was considered too small if space had to be found also for parked helicopters. Also, in the matter of helicopter size, some thought that if 12-15-seaters were likely to be economic at the start of operation in four years' time or so, then we ought to be thinking of 40-50-seaters very soon.

The cost of elevated rotorstations was held by one speaker to be likely to be fantastically high, and for the forthcoming exhibition on the south bank of the Thames, a floating rotorstation on the river was suggested. As to the siting of such stations, Mr. J. Shapiro agreed with the lecturer that there were few within a mile of Charing Cross, with one exception: Charing Cross. He thought railway stations were the logical sites for rotorstations, but Mr. Rowe replied that B.E.A. had consulted railway people, and had been asked if there was any possibility that "these things" might have mishaps and occasionally come down on the railway lines in front of a train!

A FINE FILM SHOW

After an interval for tea, some very interesting cine films were shown by Mr. Colin Cooper. First came a series of "shots" of Mr. Marsh flying the Skeeter and Air Horse. Much amusement was caused when he was shown flying the small machine literally into a hangar at Eastleigh.

Mr. Colin Cooper then projected a long colour film which he made on his recent visit to America. Those who had expected to discover from the film which helicopter configuration is likely to be the most successful were disappointed. All manner of types "evoluted" (or should it be "revoluted"?), and from the point of view of manœuvrability there appeared little to choose between them. Perhaps the most manœuvrable was the Kaman 190, whose pilot did the most astounding things with his machine. But the little tandem-rotor JOV-3 also handled remarkably well, and even took-off and landed *backwards*. Of the superimposed, contra-rotating types, the Jensen was extremely manœuvrable and, it is said, easy to fly. When it came to stability, it would appear that the Hiller 360, upon which United Helicopters vice-president, Mr. Chadwick, commented, held the lead, with its aerodynamic servo controls. But obviously there is still no finality in the matter of helicopter configurations.

The meeting was an unqualified success, and the Helicopter Association of Great Britain is to be congratulated, not only on obtaining such a distinguished lecturer, but also on the enthusiasm of its members, who never seem to mind giving up their Saturday afternoons if the subject is helicopters. That spirit, it is to be feared, has largely departed from the fixed-wing aircraft field, which is some way out of its pioneering days.

TURBO-SUPERCHARGED 4,000 h.p. WASP MAJOR

SOME details have been released concerning a compounded piston engine built for the United States Air Force which delivers 4,000 shaft horse power and several hundred pounds of thrust. The unit is basically the 28-cylinder Pratt and Whitney Wasp Major R.4360, but it is known in this case as the Major-VDT (Variable Discharge Turbine). It operates in conjunction with a two-stage General Electric variable-discharge turbo-supercharger. It is claimed that a large proportion of the energy available in the engine's exhaust gases have been effectively reclaimed and efficiency has been further improved by providing for inter-cooling of the supercharged combustion air.

General Electric's CHM-2 two-stage supercharger utilizes the exhaust gases in two ways: the first stage drives the supercharger for all combustion air required by the engine; the discharge gases from this stage are then fed through a variable-area orifice to a second stage, the shaft of which is geared back to the main crankshaft of the engine. The purpose of the variable orifice is to obtain the best division of exhaust energy between supercharger and residual thrust.

Another feature of the Major-VDT, believed to be unique, is the method of control of engine speed. A conventional type of throttle is used only for low-powers while for higher power operation, engine power and speed are described as being regulated automatically by controls which enlarge or restrict the variable-area discharge nozzle. This determines the amount of exhaust energy extracted by the turbine for supercharging, while the quantity of air delivered to the engine in turn fixes its power output. The elimination of throttling in operation is said to reduce air entry losses.

Many of the main units of this newly developed variant of the Wasp Major power plant are of standard type and as such are backed with a great deal of operational experience. The Wasp Major is the most important of very high-powered American engines. British operators will soon have experience of Wasp Majors when the Stratocruisers, which they power, are delivered to B.O.A.C.

An official 150-hour type test was completed by the Major VDT in August of last year. To make provision for the increased power output at the airscrew shaft certain engine components have been strengthened, while the elimination of the normal type of supercharger is, of course, a major modification. The overall weight of the engine has been increased as a result of these important alterations, but the power/weight ratio has been improved.

The United States Air Force has shown great interest in compounded engines for some time past, and the possibilities of a system very similar to that used for the Major-VDT was tried with the Allison V-1710 about three years ago. A more simple system for reclaiming exhaust gas energy and feeding it back direct to the airscrew shaft was described in *Flight*, October 7th, when reference was made to the Wright Turbo-Cyclone. There is a strong tendency in America at present to give the impression that there is virtually no difference between a piston engine associated with exhaust-driven turbines and a turboprop unit. Moreover, to add to the confusion Pratt and Whitney have named their home-built Rolls-Royce Nenes "Turbo-Wasps." Thus, the Turbo-Cyclone is a perfectly normal radial piston engine with small exhaust-driven turbines, and the Turbo-Wasp is a pure turbojet. The Wasp Major, which is a compounded unit, somewhat comparable with the Turbo-Cyclone, has to be content with the addition of VDT after its name to indicate its turbine association.

Aero Digest states that the first installation of the compounded Wasp Major-VDT is in the modified Boeing B-50C bomber which may be designated the B-54. The increase of 15 per cent in power brings the take-off output to approximately 4,000 s.h.p., and the maximum cruising power at 30,000ft is slightly under 3,900 h.p. Specific fuel consumption decreases with increase in altitude, being at sea level cruising conditions, 0.51 lb/h.p./hr, and at 30,000ft 0.40 lb/h.p./hr.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

RAM TEMPERATURE RISE

Speed Not the Sole Determining Factor

SINCE without an atmosphere there cannot be a ram temperature rise, however great the speed of a body, the speed cannot be the sole determining factor at very great altitudes.

While usually the pressure of the undisturbed air is irrelevant, the pressure distribution over the aircraft may be important.

Similarly, the ambient air temperature is irrelevant. I apologize for my error concerning this in *Flight* of December 2nd, and wish to thank your correspondents for drawing attention to the matter. G. R. BARRATT.

Manchester.

GROUND CREWS OF THE R.A.F.

Non-commissioned Aircrew Worse Off

I READ with great interest F. A. S. Brown's article in *Flight* of Jan. 13th on conditions within the R.A.F., but, quite naturally, he mentioned only the ground tradesman's point of view.

It should be remembered that non-commissioned aircrew are, in many respects, in a position worse than that of the tradesman. Many who were warrant officers under the old scheme are now aircrew II, and therefore come under the powers of the ACH/GD flight sergeant. Being what he is, the inferiority complex is more pronounced than ever, and he takes every opportunity of making himself unpleasant.

As Mr. Brown pointed out, the men will not be content until the ACH/GD N.C.O. has been deprived of his power. That applies equally to aircrew and ground tradesmen.

Windsor, Berks. DAVID F. OGILVY.

"Bull," not Straight Discipline is What Rankles

MUCH as I would like to see a bigger and better Air Force, as an N.C.O. Group 1 tradesman who has passed through every rank from A/C.2, I regret that I cannot see eye to eye with your correspondent F. A. S. Brown (13/1/49), although I admit that there is some truth in many of his statements.

Obviously, Mr. Brown is biased, and has presented an unfair and unjust criticism of the class of airmen categorized ACH/GD., many of whom are of as high an intellect as most Group 1 tradesmen.

Someone must be efficient in administering discipline and drill in a Fighting Service (most technical N.C.O.s are far from proficient), and who is better qualified to do so than the ACH/GD., who has been specially trained for this work? Air Chief Marshal Sir Philip Joubert was right when he said (December 9th, 1948) the R.A.F. needs more discipline, but discipline administered by officers and N.C.O.s who have been trained to handle men correctly and administer this discipline in the right manner—a matter entirely different from the enforcement of "bull" under the cloak of discipline. This "bull," and not straight discipline, is what rankles the average serving airman and makes him anxious for his release, with an avowal never to return to the ranks of the R.A.F. voluntarily—a symptom which seems apparent in the case of Mr. F. A. S. Brown.

The main cause of this trouble lies in the almost despotic powers granted to officers and N.C.O.s who have not been properly trained in the true meaning of the word "discipline." Properly administered discipline will make a Commander respected by, and endeared to, his men, who will invariably follow such a leader through fire and water—even Hell itself, if the occasion demands. True discipline commands respect from all ranks.

Truly, the administration of the R.A.F. leaves much room for improvement—a condition which will, I think, eventually be righted; but so far as Mr. Brown's attitude is concerned, I fear that his short four years with the R.A.F. did not even teach him the difference between "discipline" and "bull," that oft-misinterpreted meaning of the word discipline.

When officers and N.C.O.s are better educated to the true meaning of discipline, "bull" will disappear, and the Service will be so much more contented and happy; but I cannot imagine that this is one of the fundamental causes of dissatisfaction in the R.A.F. The root of the trouble lies much deeper and in other channels, but a solution will be found; and if this adverse criticism of Mr. Brown's is the best he can do towards the establishment of a better Air Force, then I suggest that he gives it up now and waits for intelligent men like Sir Philip Joubert to find the answers which will iron out the present difficulties. ALEX. A. METCALF.

Newcastle-on-Tyne, 5.

R.A.F. RECRUITING

Some Suggestions from a Serviceman

DUE to the publicity given to the economic plight of those who serve in the R.A.F., many serving airmen have the impression that they are wasting their time in a non-productive job; and the public feel that the Service is an unnecessary luxury. Surely the Government should stress the fact that, unless we maintain our position in the Middle and Far East, we shall lose our greatest dollar-earning exports, oil and rubber.

A more imaginative approach must be made to the recruiting problem. I feel that the following suggestions would help:—

1. Hammer home the fact that military power is necessary to maintain our economic position.
2. Give every suitable regular tradesman the opportunity to fly as part-time aircrew.
3. Ensure, as far as possible, that every regular finds employment when he leaves the Service.
4. Give more opportunities for promotion.
5. Give the married man a "square deal."

"AIRMINDED."

A VERY SILENT SERVICE!

What is Wrong with R.N.V.R. and R.N.V.(S.)R.?

ONE would have thought that Mr. Simon Warrender's recent letter (*Flight*, December 16th) upon the sad state of affairs connected with R.N.V.R. and R.N.V.(S.)R. flying training, or the lack of it, would have caused a flood of correspondence from ex-Naval pilots. I noted with interest that the letter referred to also received publicity in a national daily newspaper, a London evening newspaper, another weekly aviation journal, *The Navy* (January issue), and the *Air Reserve Gazette*. It is reasonable to assume, therefore, that it has been read by many of those to whom it was obviously addressed.

To my amazement, not one R.N.V.R. or R.N.V.(S.)R. officer appears to be sufficiently interested either to comment or offer a constructive suggestion! Surely the question of reserve training facilities is one of national importance, as well as an indication of keenness on the part of those concerned? I venture to suggest that if Mr. Warrender had written as an R.A.F.V.R., or Territorial Army officer, a great number of replies would have been received from ex-members of those Services.

Does the absence of correspondence upon a vital subject mean complete disinterest? If so, it is no wonder that the Admiralty do not make even a Tiger Moth available for the many who, by reason of age or other factors, are not eligible for flying training under the present Admiralty policy.

North Cheam, Surrey. "FLAT ABACK."

CLIPPED WINGS

The Development of Warlike Tendencies

WHILST agreeing with your correspondent, G. Sandys-Lumsdaine, regarding the neglect of our own air defences, I cannot but oppose his views (and those of certain other correspondents) concerning the denial of flying facilities to Germans.

The objections to such facilities appear to be based upon two lines of argument, i.e. (1) Germans are ex-enemies, so they have no right to fly; (2) by allowing them to fly it would develop military tendencies with disastrous results to ourselves.

The first argument is extremely weak, for it is not based upon a fair and just assumption, but upon malice, and a certain amount of hatred. Also, the phrase that "they are ex-enemies" has nothing whatsoever to do with their "right to fly." If one man, given the qualifications of a pilot, has a "right to fly," so has any other; race does not enter into it.

Correspondence . . . . .

Again, the attitude expressed by this argument cannot last for ever, but will ultimately break down, either by the force of counter-argument, a sense of justice, or simply by the passage of time, when it will just wear itself out of old age and die with the "haters"!

Regarding the second argument, a man's ability to fly, and his enjoyment of it, will not, and obviously cannot, of itself "develop military tendencies," and still less will it do so with "disastrous results." Does the driving of a motor car develop military tendencies among prospective army drivers? Or the riding of motor cycles develop military tendencies among motor cyclists? Again, does the enjoyment of simple walking develop military (i.e., infantry) tendencies?

Surely it is time all this fear, and condemnation of certain activities and productions automatically being "warlike developments" or "having warlike intentions" came to an end; for how is one to know where to draw the line? Where do "warlike tendencies" end and peaceful ones begin? The manufacture of trousers, so essential to soldiers, could easily be condemned as a "warlike industry" because it is essential to military activity. So with the button which the soldier, sailor and airman must have to hold his "warlike trousers" up; should this manufacture be stopped because it is a "military activity"? Or will the manufacture of food have "disastrous results" for us, for without doubt food is the greatest military requirement of all? Would anyone dare suggest, though, that because food is so necessary to every warlike activity it automatically "develops military desires or tendencies"?

It is time that those people who persist in looking backwards at past events turned their eyes a little towards possible future events. The future definitely looks doubtful, and a simple survey of current events will show the great need, not only for our own full preparedness against a possible enemy, but for good friends who can, and would, render us useful assistance. Many Germans both could and would fill this need only too gladly in any military adventure which may be forced upon us, and what British pilot is there who, from experience, would not say that such assistance from Germans would be worth having?

In short, to deny Germans the right to fly not only irritates them (who are already irritated enough by defeat) and belittles us, but deprives us of a very competent prospective ally.

London, S.W.4. FRANCIS W. ASHFORD.

THE BERLIN AIR LIFT
Freighters not the Only Twins

WITH reference to the advertisement material used by the Bristol Aeroplane Company, Ltd., on the back page of *Flight* dated January 6th, 1949, we would like to point out that, to us, having been employed on the Air Lift from its commencement, their statements are nothing short of balderdash.

The Air Lift was started and maintained in its early days by squadrons of Dakota (twin-engined) aircraft of Transport Command and U.S.A.A.F., and to my knowledge at least six of the R.A.F. squadrons are still operating, not to mention the U.S.A.A.F. and civil airline Dakotas.

Backloading is carried out as directed by H.Q. Air Lift and on all types of aircraft.

The only "*consistent*" backloading out of Berlin is on the P.19 service to Buckeburg, which completes a minimum of twelve lifts per day with capacity payloads, and this service is carried out by Dakota aircraft of Transport Command.

In view of the foregoing, the facts of which can be confirmed by H.Q. Transport Command, it is only fair to the crews operating on the Air Lift that in an early edition of *Flight* a disclaimer be published, which should be in the nature of an apology.

STAFF OF AIR MOVEMENTS SECTION
(who are short of a lot of sleep since the Air Lift commenced).

R.A.F. Station Buckeburg,
B.A.F.O., B.A.O.R.1.

Some "Twin Ghosts" Protest

IN your issue of January 6th you printed on the rear cover an advertisement by the Bristol Aeroplane Co., Ltd., which stated that the Bristol Freighter is the only twin-engined aircraft at present engaged on the Berlin Air Lift.

For your information, at the R.A.F. Lübeck airfield you will find nearly one hundred Dakotas and crews flying the corridors to Berlin. These squadrons originated the Air Lift, pioneered the major airfields in use in the British Zone and have been flying daily on the Lift, almost non-stop, since its inception, as well as having pioneered most of the routes in use to Berlin from the British Zone.

I think you will readily agree that the "Dak." is most definitely a twin, and although we realize that this statement was made in an advertisement, I am surprised that a periodical with the reputation of *Flight* should publish such an obvious misrepresentation of a fact surely known to anyone in close touch with current aviation affairs.

A copy of this advert has been pinned up on the "Operation Plain Fare" notice board here by someone, and is now the current joke among the Air Lift crews, who were very surprised to find that they had not been flying twins to Berlin for the last six months after all.

You can imagine the consternation this has caused among us, and psychology seems to be indicated to remove these delusions from our minds.

I hate to think what my wife will say when she reads this advertisement and discovers that I've not been on the Air Lift for the last six months after all. Any suggestions for a good excuse to give?

"ONE OF THE GHOST AIR LIFT CREWS."

R.A.F. Lübeck.
B.A.F.O.

FLYING-BOAT TRAVEL
Far More Pleasant Than Flying Omnibus

MR. SIMON WARRENDER in a letter in *Flight*, January 13th, gave some interesting evidence of the passenger's preference for flying-boat travel. Why cannot our policy-makers see the choice as the travelling public sees it?

For the ordinary passenger a lengthy flight is a rare experience for which he is compelled to pay a considerable sum of money; yet far from receiving any pleasure from the event, he is in most cases compelled to sit for hours studying the blank back of the chair ahead, or to edge down the tunnel-like aisle of his flying omnibus in a fruitless search for a change of scene. No wonder the company hurls him from A to B with more despatch than decency in order to make the ordeal as short as possible.

In marine aircraft, on the contrary, it is better to travel than to arrive. The Solent is, after all, by a long leg the world's most luxurious air liner. The spacious interior, the excitement of the short voyage to the point of take-off, the silky landing, and the historic and commercial interest of the great ports through which the routes pass, give the flying boat an atmosphere entirely its own. I am convinced that the popularity of the flying-boat cruises now being planned will prove that time spent in travelling, far from cutting into a holiday, can provide a large part of the pleasure to be obtained.

In this new form of sea travel, as in the old, Great Britain holds an unchallenged lead. Why cannot our Corporations be content to concentrate on the service we provide so well, and leave the flying charabancs and Midday Specials to less fortunate competitors? CHRISTOPHER BLACKBURN.

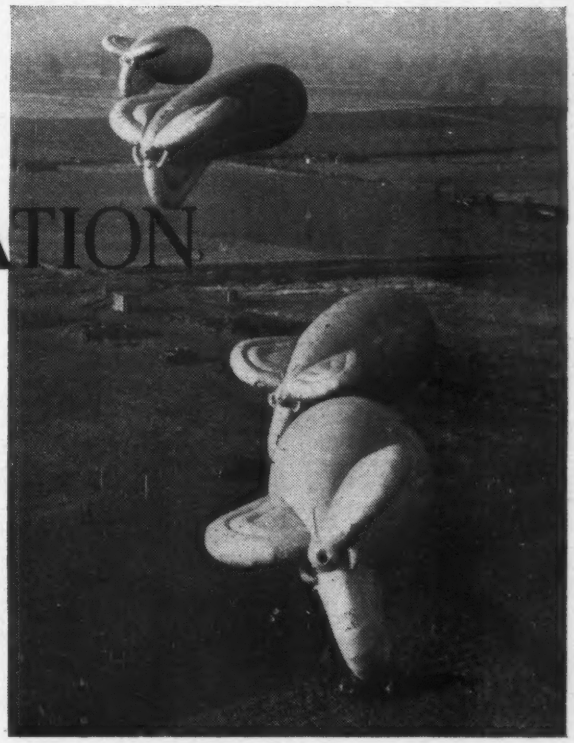
London, N.3.

FORTHCOMING EVENTS

Jan. 27th.—Royal Aeronautical Society: "Radar as an Aid to the Study of the Atmosphere," Dr. F. E. Jones, M.B.E., B.Sc., A.M.I.E.E.
Jan. 27th.—R.Ae.S. (Manchester) "Flight Testing of Civil Aircraft," P. A. Hufton, M.Sc.
Jan. 28th.—R.Ae.S. (Weybridge): Annual Dance.
Jan. 28th.—London Aeroplane Club: Banquet and Ball.
Jan. 29th.—Society of Licensed Aircraft Engineers South Eastern Area Lecture. "Rolls-Royce Power Units," W. P. Calvert, A.F.R.Ae.S. Manson House, 26, Portland Place, London, W.1, at 3 p.m.
Feb. 1st.—R.Ae.S. (Belfast): "The Propeller Turbine Engine," F. M. Owner, M.Sc., F.R.Ae.S., M.S.A.E.
Feb. 2nd.—R.Ae.S. (Luton): "The Application of Propeller Turbines to Modern Aircraft," E. J. Richards, M.A. A.F.R.Ae.S.
Feb. 2nd.—Royal United Services Institution: "Meteorology in War," Sir Nelson King-Johnson, K.C.B., D.Sc., A.R.C.S.
Feb. 2nd.—Institute of Traffic Administration: "Why Refuel in Flight," Sir Alan J. Cobham, K.B.E., A.F.C.
Feb. 3rd.—R.Ae.S. (Graduates' and Students' Section) "Notes on Fighter Development 1936–1948," Jeffrey K. Quill, O.B.E., A.F.C.
Feb. 3rd.—R.Ae.S. (Isle of Wight) "The Probable Role and Influence of Aircraft in Future Warfare," Air Marshal Sir Robert Saundby, K.B.E., C.B., M.C., D.F.C., A.F.C.
Feb. 5th.—Air Scout Movement: Exhibition at Holloway Baptist Church.
Feb. 9th.—R.Ae.S. (Leicester) "Airscrews," E. Danvers.
Feb. 9th.—R.Ae.S. (Southampton) "Radio Aids," F. R. Wills.
Feb. 9th.—Royal United Services Institution: "Land/Air Warfare," Air Vice-Marshal W. L. Dawson, C.B., C.B.E.
Feb. 9th.—R.Ae.S. (Weybridge): "Civil Air Transport," P. G. Masefield, M.A., F.R.Ae.S.

Royal Air Force and Naval Aviation News and Announcements

SERVICE AVIATION



STILL FLYING: Although seen in fewer numbers than in wartime, the bulbous form of the barrage balloon is a familiar sight in districts where the training of parachute troops, both regular and territorial, takes place. This picture comes from the R.A.F. Balloon Training Unit at Cardington

R.A.F. Appointments

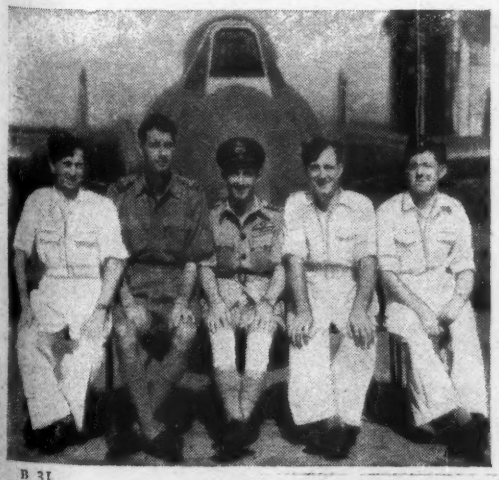
A NUMBER of new R.A.F. appointments have been announced by the Air Ministry. A. V-M. L. Darvall, C.B., M.C., who is to be Air Officer in Charge of Administration, Flying Training Command, was until recently A.O.C. No. 3 Group, Bomber Command. Before this appointment he was A.O.C. Italy, from June, 1946, until March, 1947. He was commissioned in the Green Howards in 1916 and transferred to the R.A.F. two years later. The new A.O.C. for Bomber Command's No. 1 Group is A.V-M. G. H. Mills, C.B., D.F.C., whose promotion to his present rank was announced in the half-yearly list, effective from January 1st last. He has been Director of Plans at the Air Ministry since June, 1946, until lately, and was formerly A.O.A., R.A.F. Mediterranean and Middle East for nearly a year. During the last few months of the war he commanded the Balkan Air Force. A.V-M. Mills was commissioned from Cranwell in 1921.

A former Ireland and R.A.F. Rugby captain, and until recently Director of Weapons at the Air Ministry, A.Cdre. G. R. Beamish, C.B., C.B.E., has succeeded A.Cdre. R. L. R. Atcherley as Commandant of the R.A.F. College. A.Cdre. Beamish was himself a Cranwell cadet in 1923-24, and won the Sword of Honour. Formerly Commanding Officer of R.A.F. Station St. Athan, A.Cdre. W. A. Opie has taken up the appointment of Senior Technical Staff Officer at H.Q., Air Command, Far East. He joined the R.A.F. as a boy and became a pupil pilot in 1921, graduating from the R.A.F. College the following year. Before going to St. Athan, A.Cdre. Opie was Director of Servicing and Maintenance at the Air Ministry.

The Women's Royal Air Force

IT is officially announced that, from February 1st, women will be enlisted and commissioned in the Royal Air Force. The title "Women's Royal Air Force" will be used as a collective term to describe women serving in the R.A.F., with which they will be fully integrated. Women may volunteer for most R.A.F. trades. They will be trained side by side with airmen to the same trade standards and will have the same prospects of promotion to N.C.O. rank as airmen. Disciplinary code will be the same except for necessary modifications. Officers will normally be selected from among serving airwomen, and commissioned for four to five years, with possible extension to ten years. Short service women officers will be eligible for permanent commissions in the same way as men. Professionally qualified women may be selected for direct-entry commissions in the Medical, Dental, Education and Catering Branches. Serving members of the W.A.A.F. may enlist in the R.A.F. to complete their present engagement or enter into a new R.A.F. engagement for a longer period. Officers with over 4 years commissioned service may apply for a permanent commission, and other officers may apply for a short service commission, or for a temporary commission, to complete their present engagement.

Similar conditions for the Reserves are also being introduced on February 1st. Women now serving in the present W.A.A.F.V.R. or W.A.A.F.R. will be enrolled in the Women's Royal Air Force Volunteer Reserve or the Women's Royal Auxiliary Air Force. In the new women's services, both Regular and Reserve, the rank titles of Assistant Section Officer and Section Officer will be changed to Pilot Officer and Flying Officer. The official Air Ministry statement says the changes are intended to avoid confusion with certain civilian officers in the Air Ministry Works Directorate.



VAMPIRE IN SIAM: Seen with the D.H. Vampire 3 which recently visited Bangkok, Siam are: (L. to R.) A/C. Primrose, fitter; Mr. L. Westlake (D.H. "rep."), F/L. Francis, A.F.C., pilot; Cpl. Osborne, rigger; and A/C. Mason, electrician.

Future Indian Air Power

SARDAR BALDEV SINGH, the Indian Defence Minister, told officers and men of the Royal Indian Air Force on January 9th that the R.I.A.F. would be strengthened in keeping with the size of the country. Present plans were to increase its strength to 20 squadrons. "As soon as we can get trained personnel, we will do so," he added.

Rates of Climb

THE R.A.F. Mountaineering Association, which has increased its membership from 19 to 75 in its first year, is planning to hold its summer meet in the French Alps. Other climbing meets will be held in Wales, the Lake District and Scotland, and it is hoped to hold a ski-ing meet in Scotland in conjunction with the R.A.F. Winter Sports Association. More ambitious plans are contemplated as the members gain in experience and the possibility of a future expedition to the Himalayas was suggested at the recent annual meeting by Mr. Frank

Service Aviation . . . . .

Smythe, the well-known authority on mountaineering, who is a vice-president of the association.

"Sunrise" Correction

IN the report on the air/sea warfare exercise "Sunrise" (*Flight*, December 16th, 1948) it was stated that the Lancaster F-Freddie which operated from Gibraltar in the initial stages of the exercise, was captained by F/L. R. Wise. In point of fact, Plt. II W. Harnett was the captain of this aircraft, and it is to this pilot that the credit is due for executing brilliantly an exceedingly difficult operation.

Fighter Squadron Competition

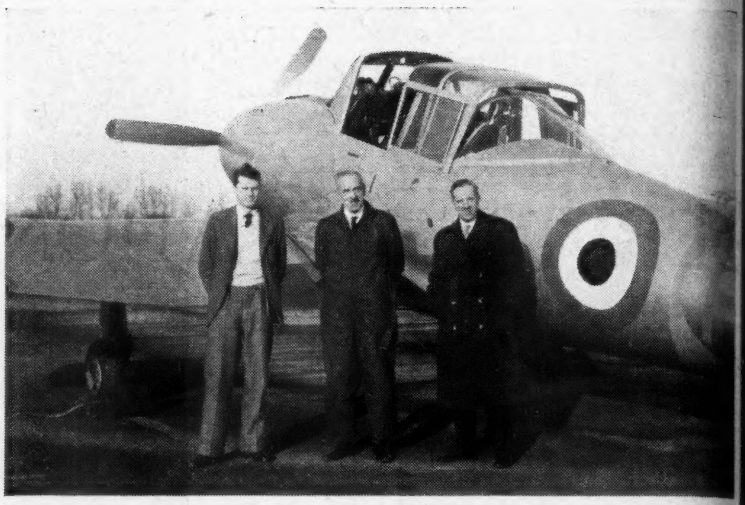
DAY fighter squadrons in Fighter Command and the British Air Forces of Occupation, Germany, will compete annually for the "Duncan Trophy," which has been presented by General Gervasio Duncan, Chief of Staff of the Brazilian Air Force, in commemoration of his 1947 visit to the R.A.F. The trophy will be awarded to the unit adjudged to have made the greatest contribution towards flying with safety under all-weather conditions. Squadrons will maintain monthly records of flying carried out in poor visibility, and of any individual advancement in all-weather flying, such as the investigation of icing characteristics and techniques for combating this hazard, development of technique for flying in turbulent areas, interception at high altitudes or in bad weather, and suggestions for improvements in instruments and weather flying aids and procedures.

The first year's competition will begin on March 1st. Inscribed on the separate ebony base of the trophy, a two-handled silver cup, are the words: "To the members of the Royal Air Force from their comrades of the Brazilian Air Force in recognition of their outstanding feats of gallantry in the Second World War and as a token of friendship and goodwill."

R.A.F. Help to Shepherds

SITUATED in a great sheep-farming area of the Highlands, the R.A.F. Coastal Command station at Kinloss (Morayshire) has often been called upon to assist flock-masters by using aircraft to drop fodder to snow-bound flocks in inaccessible hilly areas. Need for this service has not so far arisen this winter—there have been no really heavy snowfalls as yet—but Kinloss is ready to meet calls if they arise. To obviate past difficulties in getting supplies of fodder when called on in emergency, stocks of baled hay have been provided by local farmers and are now stored at the station in readiness. But Kinloss is ready to take its assistance further. It has a strong and well-equipped Mountain Rescue Unit which has done good work in the past in taking help to aircraft crashes in the Hills. The Unit offered to the Morayshire farmers assistance, if required, in searching for sheep lost in blizzards and snowdrifts. This suggestion was so well received locally that the Unit made the proposal direct to the National Farmers Union of Scotland, which has now passed it on, with approval, to its area secretaries in the counties of Ross and Cromarty, Sutherland, Inverness, Caithness, Banff and Aberdeen.

Commanding Officer of the Unit—appropriately enough, he is F/L. D. F. Shepherd!—comments that since the Unit needs regular exercises to keep up to scratch, it is ready to combine these with a "job of work" in helping farmers where possible. On the strength of the Unit are 30 well-trained mountaineers— all volunteers, and it is equipped with motor vehicles, "Walkie-talkie" radio and special navigation devices.



V.I. PILOT: The first Service pilot to fly the Mamba-powered Boulton Paul Balliol I was Air Marshal Sir Alec Coryton (A. Cdre. Harvey, please note!) Seen with him on that occasion are Mr. H. T. Chapman, Director and General Manager of Armstrong Siddeley Motors (right), and S/L. Starkey the firm's assistant test pilot.

R.A.F. Permanent Commissions

GENERAL DUTIES BRANCH.

Squadron Leader: J. E. Watts, A.F.C.

Flight Lieutenants: R. F. Atkinson, D. G. Bladon, T. N. Butcher, D.F.C., J. L. Canston, D.F.C., J. C. H. Cole, J. G. Croshaw, R. F. T. Doe, D.S.O. D.F.C., R. M. Dye, E. Evans, J. D. Grimshaw, L. G. Harris, D.F.C., J. L. Hill, T. W. Kelly, D. J. Nicholson, E. H Taylor, E. G. Tippell, J. P. Trant, E. C. Waterer, J. R. Weeds, D.F.C.

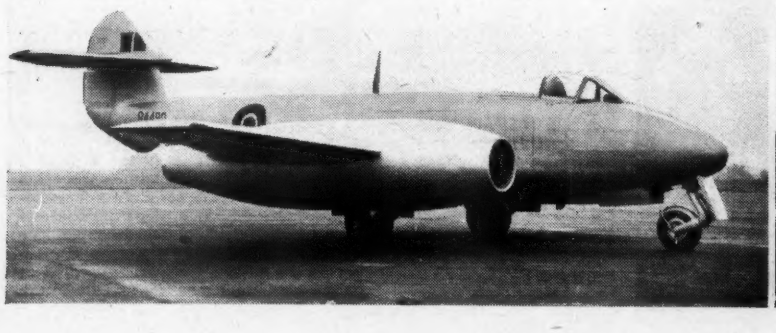
Flying Officers: C. E. Blackburn, D. J. Gordon, P. A. Leeds, N. R. Moss.

TECHNICAL BRANCH.

Squadron Leaders: A. S. King, J. F. Nazdon, M.B.E.

Flight Lieutenants: G. D. Beagarie, J. B. Bean, V. Buckman, A. V. Eynon, F. L. Finch, R. S. K. Fortune, V. J. Glanville, D. E. Hilliard, K. P. Jarman, W. R. Jones, J. W. Loxley, J. C. Munro, D. Nelson, H. W. Price, A.F.M., B. O. Ratcliffe, W. D. Reid, J. E. Smith, K. G. Thompson, A. T. Vacquier, C. G. N. White.

Flying Officers: J. C. Ellis, S. C. Turner.

Pilot Officer: N. Walling.

METEOR MODES: Illustrative of recent Gloster developments are (right) an unusual view from the front cockpit of a Meteor Mk. 7 Trainer at 10,000ft (passenger, Mr. R. Adams, of Gloster's research department) and the Beryl-Meteor below. Altered nacelle outlines distinguish the installation of its two 3,950lb s.t. axial-flow turbojets.